

CHEMICAL ABSTRACTS

Vol. 15.

AUGUST 20, 1921

No. 16

1—APPARATUS

C. G. DERICK

Measurement of rapidly fluctuating velocities in gas streams. R. SEELIGER AND K. LINTOW. *Z. tech. Physik* 1, 20-7(1920); *Science Abstracts* 24A, 154.—A description is given of an app. consisting of Pitot tubes attached to a pneumatic box which responds very quickly to fluctuations of velocity in the gas stream, and gives records of these fluctuations. The effect of the length of tube from outlet to manometer is discussed. H. G.

Uehling carbon dioxide recorder. ANON. *Engineering* 111, 626-7(1921).—A const. flow of flue gas is drawn through a chamber containing an absorbing medium. The CO₂ in the stream is absorbed and the resulting change in pressure is recorded by a manometer graduated directly in % CO₂. 4 illus. H. BUTTLER

Flash point apparatus. F. WILBUR SHULENBERGER. *Paint, Oil and Chem. Rev.* 71, No. 24, 9, 18-20(1921).—Descriptions are given of standard flash point app. with discussion of their relative merits. H. BUTTLER

A simplified carbon combustion train. W. W. BOONE. *Chem. Met. Eng.* 24, 1068(1921).—B. suggests a water pressure tank for regulation of the flow of O₂ and to do away with the const. manipulation of a reducing valve. He also suggests a tower, having the H₂SO₄ in the lower section and above, 3 layers resp., CaCl₂, soda-lime and CaCl₂, as a prewasher and in addition a bulb-tube containing resp., Zn, CaCl₂, P₂O₅, and CaCl₂ for washing the gas from the combustion. 1 illus. H. BUTTLER

Modification of the Lewis Thompson apparatus for determination of calorific values of coals. DOMENICO LODATI. *Giorn. chim. ind. applicata* 3, 105(1921).—The improvement is designed to bring about ignition of the fuse after the calorimeter has been put into the water, and thus avoid premature extinguishing of the fuse, or premature lighting of the mixt. in the furnace. The fuse is arranged so as to come in contact with a Ni-Cr wire, which is made incandescent by the current and thus lights the fuse. L. experienced practically perfect operation of the device with his modification. R. S. P.

Extraction apparatus with continuously running liquid. GUNO AJON. *Giorn. chim. ind. applicata* 3, 62(1921).—This app., a modification of the Soxhlet, is designed to prevent the intermittent siphoning off of liquid from the extg. chamber. The siphon, instead of being a tube having the same diam. along its whole length, is interrupted at a certain point, and the liquid it carries is constrained to fall into a tube of wider diam. (ratio of diams. of tubes = 1:2.4). The advantages of this form of extractor are: (1) regular boiling during extn.; (2) small amt. of solvent that has to be evapd. previous to weighing; (3) on account of the small amount of liquid required to maintain the circulation, small size of flasks that may be used with large extractors. R. S. P.

A mercury volumeter. E. F. GOODNER. *J. Am. Ceram. Soc.* 4, 288-300(1921).—A new type of volumeter for use in detg. vols. of solids, using Hg as the confining liquid. Advantages claimed are speed and convenience, particularly because the liquid is not absorbed by porous materials such as raw clays. Tests show it to be accurate to within 0.2%. J. S. LAIRD

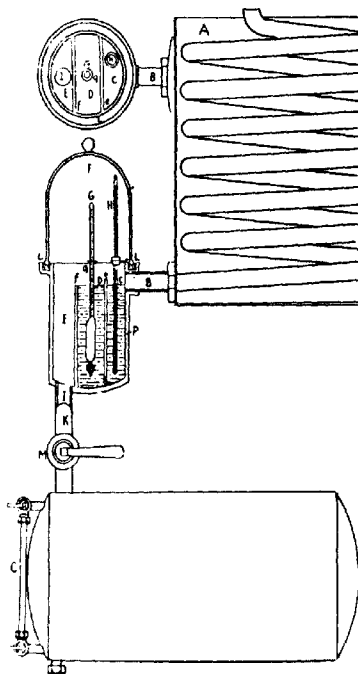
Multiple hot filters. GUIDO AJON. *Giorn. chim. ind. applicata* 3, 62-3(1921).—Description of details of app. and sketches are given. ROBERT S. POSMONTIER

The Atkins centrifugal filter press. ANON. *Caliche* 2, 148(1920).—The advantages which the rotation of the filtering medium is stated to give are: (1) Continuous elimination of the solids from the filter cloth by the centrifugal action due to the rotating filter disks. (2) The solid materials are deposited in the form of a paste on the walls of the container. (3) The filtered soln. discharges immediately and does not accumulate. (4) Either pressure or vacuum may be used. (5) Discharge of the solid materials is continuous. The app. (of which drawings are given) consists in principle of several circular filtering disks mounted on a shaft which may be rotated, the whole being enclosed in a tank or container to which pressure may be applied. C. L. BURDICK

Fairweather recording calorimeter. ANON. *Gas. J.* 154, 628-9(1921).—2 figs. The instrument is a modified type of the Boys calorimeter with water flow and means for correction for temp. and pressure conditions. It has been tested by the Gas Referees and given a limited certification. Tests have proved the accuracy of the water control, and have shown the instrument to be accurate to within 0.5%. J. L. WILEY

Density indicator for vacuum stills. ANON. *Rev. prod. chim.* 24, 369(1921).—The condensate flows from the worm *A* through *B* into the compartment *C* of the receiver *P*, through an opening at the bottom of the partition *e*, and overflows into *E*, and is drawn off through *I* and *K* into tanks. Compartment *C* contains a thermometer *H* held in place by means of a rubber stopper. Compartment *D* contains a hydrometer *G*, the stem of which passes through a hole in a piece of sheet metal resting on the edge of the receiver. The top of the receiver is closed by means of the glass bell *F* which rests on the rubber in the groove *L* so as to make a tight joint. A. P.-C.

Vacuum manometer; new type of apparatus. H. RIEGGER. *Z. tech. Physik* 1, 16-9(1920); *Science Abstracts* 24A, 153.—A short account is given of the methods hitherto employed for the measurement of very low pressures. The new instrument described consists of a suspended system made from an Al disc slit radially into a large number of sectors, each sector being then bent so as to make an angle of 45° with the original plane of the disc. This many-bladed "propeller" is suspended by a fine W thread so that its blades lie vertically beneath an annular plate, which is heated electrically. The impact of the mols. heated by the plate causes the "propeller" to rotate through a given angle, which is measured by means of a circular scale attached to it. Curves are given



to show the proportionality of torsion to pressure for pressures up to 10^{-4} mm. Hg. The effect of the nature of the gas is also shown. H. G.

Pumps for high vacua. A. GEHRTS. *Z. tech. Physik* 1, 61-71(1920); *Science Abstracts* 24A, 153-4.—According to Langmuir a high vacuum is defined as one in which the residual gases and vapors are no longer discernible by condensation methods. Taking the case where an electronic stream is passing from a glowing cathode to anode, the field produced by this stream exerts a reverse effect whereby a definite additional potential gradient dependent on the current strength is required in order to promote the electronic emission to the anode. Before the state of satn. is attained, Langmuir and Schottky's law holds, namely, $i = \text{const. } V^{1/2}$, that is, the current is proportional to the $1/2$ power of the potential. If residual gases are present to an appreciable extent in the evacuated space, the number of positive ions formed by impact ionization is increased, and the Langmuir-Schottky law ceases to be valid. From this standpoint a very complete discussion of the general characteristics of high-vacuum pumps is given, accompanied by diagrams. Curves are included, showing the suction velocity as a function of the pressure, and also of the Hg temp. Among the designs which receive special attention are Gaede's diffusion air-pump, the parallel jet pump of Crawford, and the condensation pumps of Langmuir, Gaede, and Siemens and Halske. A theoretical discussion of suction velocity concludes the paper. H. G.

Further improvements in the nephelometer-colorimeter. PHILIP ADOLPH KOBER AND ROBERT E. KLETT. Nepera Park and New York. *J. Biol. Chem.* 47, 19-25(1921).—Kober's modification of the Dubosq colorimeter (*C. A.* 11, 1440) has been further modified so as to obtain "(1) the elimination of the fatigue and annoyance due to stooping to read the scale of Dubosq instruments; (2) an enlarged and well illuminated scale read through an eyepiece of the same focal length as the telescope; (3) a more convenient position for the milled heads operating the stages, allowing for resting of the operator's arms; and (4) a micrometer arrangement for setting the zero point which can be locked in any position." I. GREENWALD

A projection spectropolariscope. F. J. CHESHIRE. *Trans. Optical Soc.* 21, 102 (1920); *J. Soc. Glass. Tech.* 4, 141.—A polariscope specially adapted for class and lecture work was described. By placing the crystal under examn. immediately against the slit from which the polarized light issued, a much sharper definition of the bands was obtained than was the case with the more usual app. H. G.

A new anemometer. H. GERDIEN AND R. HOLM. *Wiss. Veröffentl. Siemens-Konzern* 1, 107-21(1920).—The anemometer is constituted of a Wheatstone bridge, two arms of which are formed of very thin wires of high temp. coeff., heated by an elec. current and inserted directly behind one another in the stream. The leading wire is cooled by the stream to a greater extent than the second, and the galvanometer deflection thereby produced serves to indicate the magnitude of the velocity of the stream (cf. Thomas, *C. A.* 12, 1723; 14, 2280). The app. is applicable to the *measurement of the velocities of gases in pipes*. If an obstruction is placed in the pipe, with one arm of the anemometer on either side of it, measurements of large velocities may be made. The only important correction necessary to the indications of the instrument is that due to alteration of temp. of the gas. The necessary correction can be calcd. or mechanically compensated, the latter method eliminating any necessary correction to within 0.1% per degree centigrade. The device can also be employed for the measurement of high velocities by by-passing a const. fraction of the stream over the heated wires. The temp. of the wires is much below that necessary to cause corrosion of the wires due to combustion of dust or to cause ignition of explosive gaseous mixts. Impurities in the gas influence the readings of the instrument. Thus 1% of illuminating gas admixed with air reduces the sensitiveness of the instrument by about 3.5%. J. S. C. I.

Melting-point apparatus. FRITZ FRIEDRICH. *Z. angew. Chem.* 34, 1, 61(1921).—In a m.-p. app., the glass heating bath, surrounding the thermometer, is of oval section with flattened front and back, so that readings may be made microscopically without interference due to the curvature of the glass. The thermometer and m.-p. tubes are, in addition, enclosed in an inner vessel of similar cross-section, which serves to overcome the thermometer lag; and for conveniently assembling the app. without removing the thermometer, the outer vessel is provided with oblique lateral tubular extensions through which, and through orifices in the inner vessel, the m.-p. tubes are introduced near to the thermometer bulb.

J. C. S.

A new type of thickener. ANON. *Caliche* 2, 105(1920).—A description of the GENTER THICKENER and its application to the nitrate industry. C. L. BURDICK

Pyrometers and their application to steel treating (ANDREWS) 9. Simmance total-heat recording calorimeter (GRAY, BLACKIE) 21. Apparatus for simultaneous pressure and volume measurements of gases (HÜTTIG) 6.

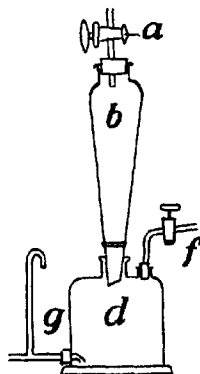
Apparatus for generating gases. F. HIRSCH. Brit. 161,681, Jan. 14, 1920. App. for generating gases such as H_2S , SO_2 , and H , comprises a tower, *b*, for the solid reagent, means, including a pipe and a cock, *a*, for supplying liquid thereto, and a chamber, *d*, to receive the spent liquid and also the gas, which is withdrawn through a connection, *f*. Surplus liquid is discharged through an outlet, *g*. The sides of the tower, *c*, are inclined to prevent too rapid subsidence of the solid reagent.

Gas-analysis apparatus. O. RODHE. U. S. 1,374,391, Apr. 12. Cf. C. A. 15, 1834. The pipe between the pump and measuring vessel of a gas-analyzing app. is provided with contracted portions, in order to retard the flow of the gas.

Optical pyrometer. F. E. BASH. U. S. 1,376,666, May 3.

Colorimeter. R. E. KLETT. U. S. 1,375,708, Apr. 26.

The colorimeter is so constructed as to require only a very small amt. of the liquid to be tested and is, therefore, suitable for blood tests.



Electric heaters. C. WIRT. U. S. 1,376,987, May 3. An elec. heater is formed by applying a conducting material, *e. g.*, Fe wire, to an insulating material such as rubber-coated fabric and then placing a second body of insulating material over the conductor and uniting the insulation so as to embed the conductor.

Apparatus for drying and ozonizing air. H. B. HARTMAN. U. S. 1,376,691, May 3. Cf. C. A. 15, 718.

Electric ozone generator. R. ROSNER. U. S. 1,374,237, Apr. 12.

Removing gas from rectifier electrodes or similar conducting bodies. J. B. PRATT. U. S. 1,374,679, Apr. 12. Enclosed conducting material such as W, Mo or Pt is freed from gases by subjection to a high-frequency variable magnetic field of sufficient strength to eliminate the gas by the heating effect produced.

Apparatus for mixing and macerating casein mixtures to form horn-like products. A. BARTELS. U. S. 1,375,623-4, Apr. 19. Cf. C. A. 14, 212.

Filter for gasoline or other liquids. H. A. DEKKS. U. S. 1,376,681, May 3.

Thermostatic valve adapted to control the flow of steam and water. S. LIPPERT. U. S. 1,376,818, May 3.

2—GENERAL AND PHYSICAL CHEMISTRY

W. R. HENDERSON AND EDWARD MACK

Nernst's heat theorem and chemical constants. II. EIICHI YAMAZAKI. *J. Tokyo Chem. Soc.* 41, 691-706(1920).—Theoretical paper, consisting of 4 parts. (1) In a previous article (cf. *Ibid* 41, 19), in an attempt to explain Nernst's heat theorem on the basis of the quantum theory, Y. used the formula $Q = 3R\beta\nu/(e^{\beta\nu/T} - 1)$ where Q = total energy of g. mol. of solid, ν = no. of mol. vibration, and β = const. (2) It is ordinarily stated that $U = U_0 + bT^2 + CT^3 + \dots$, and $A = A_0 - bT^2 + C'T^3 + \dots$, but Y. showed before $(dC/dT)_{T=0} = (d^2A/dT^2) - (d^2U/dT^2) = 0$, and therefore $(d^3A/dT^3) - (d^3U/dT^3) = 0$. If the ordinary equations are used, then, all consts. must become zero, i. e., $b = 0$, $c = 0$, $C' = 0$ and therefore $A = U$. But equality of A and U does not occur except at zero abs. and only when $dA/dT = 0$. Y. deduced a formula which would be rigid for any temp. From $dA/dT = Q/T = 3R(\beta\nu/T)/$

$(e^{\beta\nu/T} - 1)$ he obtained $A = 3R\int_0^T \frac{\beta\nu/T}{e^{\beta\nu/T} - 1} dT + U_0$ and $U = 3R\int_0^T \frac{\beta\nu/T}{e^{\beta\nu/T} - 1} dT + U_0$. If T is sufficiently high, $\frac{\beta\nu}{2} < 1$, then $A = 3R\{T - \frac{\beta\nu}{T} \ln T - \frac{(\beta\nu)^2}{12T^2}\} + \text{const.}$, and $U = \frac{1}{2} \beta\nu R\{1 - \ln T - (\beta\nu/3)(1/T) + \text{const.}$ These equa-

tions are plotted in a curve showing that as the temp. approach zero, A and U approach each other, becoming exactly equal at zero abs. (3) The second of Planck's two quantum formulas should be used for total energy calcn., $E = N(\epsilon/[e^{\epsilon/kT} - 1]) + (\epsilon/2)$. Although heat energy becomes zero at zero abs. as Nernst's heat theorem also indicates, total energy, its change and max. work for reversible system do not become zero at this temp. In (4), it is pointed out that consts. Y. had calcd. and published in the previous article should not agree with those of Nernst, but are more nearly like those of Egertons. The reasons are given why Y.'s table should be discarded. S. T.

The application of the law of limiting densities to easily liquefiable gases, and to the atomic weight of sulfur. EUGÈNE WOURTZEL. *J. chim. phys.* 18, 142-50(1920).—In their study of the compressibility of SO_2 , Jaquero and Scheuer (*Mém. soc. phys. gen.* 35, 660(1908)), employed for the detg. of the deviation from Avogadro's law, an extrapolation of pv as a parabolic function of p . This extrapolation was based upon the equation $1 - [(p'v')/(p''v'')] = A(p'/p'')(p' - p'')$. In this equation the denominator $(p''v'')$ is a variable, as well as the numerator $(p'v')$, and this fact explains why J. and S.'s deviation coeff., $A = 0.02379$, was too large, and their mol. wt. of SO_2 too small. This low result has heretofore raised a doubt regarding the practicability of applying the law of limiting densities to easily liquefiable gases. Now, however, W. finds that an extrapolation of pv as a linear function of p , namely, $pv = 1 + \lambda - [\lambda(p - 1)]$, whence $A_0 = \lambda/(1 + \lambda)$, gives a straight line with J. and S.'s data very concordantly throughout the range 200-800 mm., at 0° . This expression gives $\lambda = 0.02401$, and $A_0 = 0.02345$, from which the mol. wt. of SO_2 is calcd. to be 64.059, and the at. wt. of S 32.059. This value of the physico-chem. mol. wt. of SO_2 is considered to be definitive. The agreement of this value of the at. wt. of S with those detd. by other types of methods is rather remarkable in view of the fact that SO_2 at 0° and 1 atm. is near its liquefaction point, under which conditions the law of limiting densities is applied under most adverse conditions. If pv is expressed as $f(1/v)$, namely, $pv = 1 - \lambda \{ [1/v] - 1 \}$, J. and S.'s data give a curved line, and the coeffs. calcd. for neighboring pressure intervals differ from one another more than would be expected from the exptl. error, although their mean value is nearly the

same as that calcd. from the above linear equation in p . The equations used by Ph. A. Guye, $p\bar{v} = 1 + \lambda(A_p) + p(B_{ps})$ and $p\bar{v} = 1 + \lambda' + [A'(1/v)] + [B'(1/v^2)]$, may be expressed in terms of the consts. of van der Waals' equation as follows: $p\bar{v} = 1 + \lambda - \{[a - b(1 + \lambda)]/(1 + \lambda)\} - [a(a - 2b)p^2]$, and $p\bar{v} = 1 + \lambda - \{[a - b(1 + \lambda)]/v\} + [b^2(1/v^2)]$. The values of a and b are not known with sufficient accuracy for calcg. the coeffs. of the first degree terms, but they may be used for detg. the order of magnitude of the second degree terms. For SO_2 , $a(a - 2b) = 0.00066$, and $b^2 = 0.063$. Therefore, when expressing $p\bar{v}$ as $f(1/v)$, the second degree term is negligible. If it is necessary to take into account polymerization of the gas, then, $p\bar{v} = 1 + \lambda' - [(1/K)(p)] + [(3/K^2)(p^2)]$. In this expression $K = 2P[(1 - x)^2/x]$, where P is the pressure if dissociation were complete, and x is the fraction polymerized. In this last expression for $p\bar{v}$, the second degree term is positive while in the last two equations above it is negative. Therefore for a small degree of polymerization the curve $p\bar{v} = f(p)$ will be nearly straight, but slightly curved in a way to diminish the curvature due to the physical cohesion, or the curvature may even be inverted in the sense opposite to that to be expected from van der Waals' equation.

R. H. LOMBARD

An analysis of molecular volumes from the point of view of the Lewis-Langmuir theory of molecular structure. ROBERT N. PEASE. *J. Am. Chem. Soc.* **42**, 991-1004 (1921).—Isosteric mols. and nuclear atoms in H compds. have the same vol. The vol. depends on the no. and arrangement of electrons surrounding the positive nuclei rather than on the nature of the nucleus, i. e., kind of atoms. Thus nuclear C, N, and O of CH_4 , NH_3 and H_2O , resp., have the same vol. C atoms in C_2H_4 , C_2H_2 and C_6H_6 have vols. increasing with the degree of unsatn., as is also true with benzene and cyclohexane. The vols. of atoms thus increase with the no. of electron pairs held. N_2 and CO probably have the normal or acetylenic structure rather than the condensed structure ascribed by Langmuir. In NO there are also 3 pairs of electrons shared as in N_2 with the extra electron at the center of the triangle formed by the 3 pairs. This explains its small mol. vol. and the absence of color. The vols. of the rare gases are fully considered from the standpoint of Langmuir's views in relation to the vols. of other atoms. G. L. CLARK

Recent advances in science—Crystallography. ALEXANDER SCOTT. *Sci. Progress* **15**, 547-50 (1921); cf. *C. A.* **15**, 209.—Review of recent work on the arrangement of the atoms in the crystals of various elements and compds., as shown by the X-ray.

JOSEPH S. HEPBURN

Anisotropic liquids. J. STEPH. VAN DER LINGEN. *J. Franklin Inst.* **191**, 651-77 (1921).—A study of p -azoxyanisole, p -azoxyphenetole, anisaldazine, and Am p -cyanobenzalaminocinnamate (Stumpf's ester) demonstrated clearly and definitely that the pseudoisotropic layers do not possess homogeneity of structure as this term is used in crystallography. No evidence was found that such layers are microcryst. Therefore, the conclusion was drawn that such layers of anisotropic liquids do not possess a space lattice. The uniform dispersion, which was always observed, was wholly due to the regularity of mol. structure of these anisotropic liquids, probably produced by similarly orientated ellipsoids, one of whose axes only was fixed in space. A bibliography of 3 pages is appended.

JOSEPH S. HEPBURN

The specific dispersion of hydrocarbons. E. DARMOIS. *Compt. rend.* **172**, 1102-5 (1921).—In an earlier paper (*C. A.* **15**, 622) D. has observed that the specific dispersion, $\Delta n/d$, i. e., the difference between refractive indices for 2 spectrum lines, generally H_α and H_γ , is an approx. const. quantity for each series of hydrocarbons present in petroleum fractions. Since the numbers obtained from expt. are variable in certain cases, it is interesting to compare them with values calcd. by the aid of atomic refractions according to Lorentz. The approx. constancy of the specific dispersion, a rule drawn directly from experimental evidence, is theoretically predicted for satd. hydrocarbons.

The agreement with calcd. results is much less perfect when the hydrocarbon contains one or more ethylenic linkages. The widest variation in each series is in every case much less than the value calcd. for it.

Some fundamental conceptions of colloid chemistry. RICHARD ZSIGMONDY. Göttingen. *Z. physik. Chem.* 98, 14-37(1921).—It is pointed out that (1) ultramicroscopic studies of colloidal metals and oxides and also of dyes, (2) the magneto-optical investigation of colloidal Fe_2O_3 , and (3) the studies of the double refraction of cellulose and nitrocellulose and of pleochroism of colored fibers and distended gelatin containing metal, all confirm Nägeli's conception of micelles or cryst. primary particles. Further, X-ray photographs of different colloids have removed the last doubts as to the real existence of very small ultramicroscopic crystals. However, further developments in colloidal chem. have necessitated a limitation of the conception of micellar-solution, because it has turned out that not only cryst., but also liquid primary particles, can be contained in colloidal soln. To-day it is established that in many colloidal solns. the division of particles continues down to the single mols., which, however, do not pass through a parchment membrane. It is suggested that, in cases in which nothing has yet been detd. regarding the nature of the "solution-units" present in the hydrosol, the term "primary particle" be used, while particles formed by the agglomeration of primary particles be designated by "secondary particles." While colloidal mols. and cryst. and amorphous particles may be classed together as a preliminary measure, it must be the endeavor of every investigator in the field of colloidal chem. to differentiate between these kinds of particles, as well as to classify sols and gels according to structural relations.

H. JERMAIN CREIGHTON

Photometric methods and apparatus for the study of colloids. S. E. SHEPPARD AND FELIX A. ELLIOTT. *J. Am. Chem. Soc.* 43, 531-9(1921).—Photometric methods are described which it is intended to apply to the study of colloid solns. such as gelatin solns. Two types of instruments are described. The first is a tyndallimeter by means of which the Tyndall cone is photometered. From such a measurement the particle size can be computed. It is also useful as a means of specifying turbidities. The 2nd app. is more complicated and correspondingly more useful. It is easily converted into a colorimeter, nephelometer, microphotometer, turbidimeter or dispersimeter. The last named modification is novel in that it is proposed to measure or specify the dispersity or periodicity of a polyphase system by use of the ratio of the magnifications necessary to make images of a standard dispersity and the unknown appear equally disperse. The two are compared side by side through a photometer cube used in the other modifications.

FELIX A. ELLIOTT

The coagulation of inorganic suspensoids by means of emulsions. WILLIAM CLAYTON. *Kolloid-Z.* 28, 233-5(1921).—As a rule, suspensoids cause mutual pptn. only when they are mixed in proper proportions and also when adsorption takes place. Electrolytes and some nonelectrolytes ppt. colloids. But emulsions often are protective colloids. C. describes the rapid and complete pptn. of an unnamed inorg. solid suspensoid by the addition of a very small proportion of starch. In pure water the particles of both the starch and the solid are negatively charged, but the pptn. takes place rapidly. Dissolving the starch by boiling in dil. NaOH doubles its pptg. power. The effect of the alkali starch in correct proportions produces the oil-in-water type of emulsion if one insures proper speed of rotation of the agitating disks, the required ratio of vacant space to vol. of mixt. and proper duration of treatment. Several different oils or fats are suitable. The addition of salt or one of several emulsifying agents aids in the formation of the emulsion.

F. E. BROWN

The reversible sol-gel-transformation. S. C. BRADFORD. *Kolloid-Z.* 28, 214-7(1921).—The theories of gel structure may be grouped under three heads: (1) gels are

super-cooled liquids; (2) gels are composed of two liquid phases; and (3) gels are composed of a solid and a liquid phase. The third is the correct view. There is a gradual change from gross suspensions through sols to true sols. Sols are closely related to supersatd. sols. as is shown by the common sensitiveness to the presence of electrolytes. The characteristics of a colloid soln. depend on either one alone or both of the following: (1) the degree of supersatn; (2) the size of the particles. Suspensoids are comparable to metastable sols. and emulsoids to true sols. Work with gelatin sols. leads B. to conclude that one may consider the sol-gel transformation as an extreme case of crystn. The fact that the particles are spherical does not prove them to be liquid, for several organic substances have a tendency to crystallize in spherical form. The question whether the globular form of the particles of a gelatin gel is or is not due to a framework is an open one and is complicated by the fact that the elasticity of the outer skin of the gelatin gel is from two to three times the viscosity of the inner part of the gel.

F. E. BROWN

Inversion of phases in emulsions and precipitation of suspensions by means of electrolytes. S. S. BHATNAGAR. Univ. College, London. *Kolloid-Z.* **28**, 206-9 (1921); cf. *C. A.* **14**, 3555.—Two former methods of detg. the phase occupied by oil and by water in an emulsion are the indicator method and the drop method. In the first, the presence of the indicator changes the character and stability of the emulsion. In the second, one assumes that the phases remain unchanged when a drop of the emulsion is added to an excess of either constituent. This is not true near the point where inversion takes place. B. gives a third method which depends on the fact that oil-water emulsions are comparatively good conductors of electricity while water-in-oil emulsions show very little cond. (cf. *C. A.* **14**, 3555). Using this method of detecting the inversion of the phases of emulsions, B. found that there is a close parallelism between the effect of several ions of different valences in causing inversion of phases in emulsions and the effect of these same ions in causing the precipitation of suspensoids. Since the cleansing action of soap depends on emulsification it is important that wash waters be free from electrolytes, and especially from those which form ions whose valence is greater than one.

F. E. BROWN

A contribution to the dispersoid-analysis of non-aqueous solutions. WO. OSTWALD AND P. WOLSKI. *Kolloid-Z.* **28**, 228-33(1921).—Membranes suitable for dialysis and diffusion of aq. solns. or suspensions may not be satisfactory for non-aq. solns. Research with an alcosol, HgS in 96-97% alcohol, using parchment paper, collodion, rubber, and gelatin as membranes, is reported. The prepn. of the sol and of each membrane is described. The comparison of the behavior of this sol with the behavior of other substance spontaneously sol. in 97% alcohol indicates that the latter are molecularly disperse substances. Zein, the albuminous component of maize, is appreciably dialyzed.

F. E. BROWN

The elastic properties of gelatin jellies. S. E. SHEPPARD AND S. S. SWEET. *J. Am. Chem. Soc.* **43**, 539-47(1921).—This is a continuation of work previously reported (*C. A.* **14**, 3818) dealing with the detn. of the modulus of elasticity of gelatin jellies of various concns. The authors give measurements of "the rigidity of gelatin jellies, showing that the jellies follow Hooke's law nearly up to the breaking point. The relation of the modulus of elasticity to the concn. of gelatin is discussed. It is found that a function of the type $E = k c^n$ is valid for a certain range, but that the consts. k and n may vary from one grade of gelatin to another. The influence of acidity and alkalinity on the elasticity has been followed quantitatively. pH measurements show that the observed variations in the elasticity are not a simple function of the actual H-ion concn. The influence of alc. and glycerol in different concns. on the coeff. of rigidity has been measured."

FELIX A. ELLIOTT

The difference of potential acting in electroosmosis and related phenomena. H. FRÜNDLICH. Kaiser Wilhelm Inst. *Kolloid-Z.* 28, 240-2(1921).—The relation between ζ , the electro-kinetic potential of the Helmholtz equation, $\zeta = 4\pi\eta E/PD$ and ϵ , the ordinary potential difference of Nernst, was investigated. In measuring ζ a capillary tube of $1/8$ mm. bore about 10 cm. long was used and the liquid was driven through by pressure of nitrogen. The value of ζ was found to depend on the concn. of the electrolyte, the valence and other characteristics of the cations. The higher the valence the more effective were the ions: trivalent cations even reversed the charge on the glass. To measure ϵ a thin-walled blown glass bulb filled with 0.1 *N* KCl soln. was dipped into the same solns. as were used in the detn. of ζ . This app. seemed to act as hydrogen electrode and in the presence of a mixt. of sodium acetate and acetic acid showed no changes of potential on the addition of comparatively large amts. of $AlCl_3$. F. concludes that ϵ is the potential difference between the body of the glass and the body of the liquid and ζ is the potential difference between the liquid flowing in the tube and the liquid adhering to the walls of the tube, and that these are in no way identical.

F. E. BROWN

Casein viscosity studies. HARPER F. ZOLLER. Bur. Animal Ind. *J. Gen. Physiol.* 3, 635-51(1921).—The max. viscosity of casein in solns. of NaOH, KOH, LiOH and NH_4OH occurs at nearly the same p_H for each alkali, *i. e.*, 9.1-9.25; the same is also true for casein in solns. of Na_2CO_3 , Na_2AsO_4 , Na_2SiO_3 , NaF, and Na_2PO_4 . In borax solns., the max. viscosity was attained at p_H 8.15-8.2 and the suggestion is made that casein acts like mannitol and glycerol in increasing the dissociation of boric acid. "The flattening of the viscosity curves of casein solns., following the decline from max., is shown to be due to alk. hydrolysis, whence casein no longer exists as such but is cleaved into a major portion contg. no P or S and less N. This cleavage commences at p_H 10.0 to 10.5". High temps. (60° or above) affect casein to such an extent that its alk. solns. have higher viscosity than the alk. solns. of unheated casein. CHAS. H. RICHARDSON

The diffusion process in solid gold-silver mixed crystals and the measurement of the coefficient of diffusion of gold in silver at 870°. W. FRAENKEL AND H. HOUBEN. *Z. anorg. allgem. Chem.* 116, 1-15(1921).—A new method for studying diffusion processes in metallic mixed crystals is explained. Au-Ag mixed crystals in contact with Au after etching for a half hour in $(NH_4)_2S$ soln. are colored deep black with a content of Au up to 0.06 mol. and blue black from 0.06 to 0.12 mols. The alloy of the same concn. without contact with Au cannot produce such coloration. Microscopic and photomicrographic exams. revealed the possibility of measuring the diffusion coeff. This was found to be 0.000037 cm.² per day at 870° (100° below the m. p. of Ag). G. L. C.

The transformation of acid salts of dibasic acids in aqueous solution: The influence of the base on the degree of this transformation. TH. SABALITSCHKA AND H. SCHRADER. *Z. anorg. allgem. Chem.* 116, 183-92(1921).—The extent of the transformation of an acid salt of a dibasic acid in aq. soln. to neutral salt and free acid depends, for any single base, on the ratio of the two ionization constants of the acid. If a dibasic acid is thought of as two monobasic acids of different ionization consts. then the equil. conditions for any fairly strong base should be independent of the base. In this paper the influence of the base is studied by dialysis of the acid sulfates of Na, NH_4 and aniline, and by distribution between water and ether of the free acid from solns. of the acid succinate and α -camphorate of K and NH_4 . The results in the case of aniline could not be used owing to excess hydrolysis. Both distribution and dialysis methods indicate that the degree of transformation into free acid and neutral salt increases with the strength of the base.

A. E. STEARN

Theory of the electrolytic ionic condition and the calculation of the electrolytic solution constants as well as related quantities from chemical affinities. KARL FREDEN-

HAGEN. Leipzig. *Z. physik. Chem.* 98, 38-69(1921).—A theoretical paper in which a theory of the electrolytic ionic condition is developed. The paper does not lend itself to abstracting, and for an outline of the theory the original must be consulted. The theory, which explains many difficulties presented by inorganic solns., shows under what conditions ordinary dissociation goes over into electrolytic dissociation. By means of this theory the electrolytic soln. const. of the elements and the partition and dissociation const. of chem compds. can be calcd. from chem. affinities and a factor depending on the condition of the solvent. The theory also permits a qualitative representation of the elec. and dielectric behavior of conductors of the second class. H. J. C.

The equivalent weights of several bases in permutite. A. GÜNTHER-SCHULZE. *Z. anorg. allgem. Chem.* 116, 16-20(1921); cf. *C. A.* 15, 332.—Samples of Na, K and NH_4 permutite (base 1) were shaken with solns. of salts of other metals (base 2) and the soln. was then analyzed to discover how many millimoles of base 2 going into the permutite remained behind. From this by simple calcn. the equiv. wts. were obtained. Wide differences in the constant $(\text{Base 2/Base 1})_{\text{permutite}} : (\text{Base 2/Base 1})_{\text{soln.}}$ are found. From cond. data on the dissociation of permutites it would be expected that the const. for the action of Ag, Tl and the alkalis on the permutite (most highly dissociated permutites) should be about 1, the alk. earths about 10, and all others very large (since the dissociation is very small). This is only partially true, however, since Ag and Tl go over strongly into the permutites, although their permutites are strongly dissociated, while Ni and Co remain predominately in soln. though their permutites are very weakly dissociated. The author has no explanation for this. In general a base goes over into the permutite more strongly the higher the at. wt. G. L. CLARK

Chemical affinity. A. KOREVAAR. *J. Phys. Chem.* 25, 304-10(1921).—See *C. A.* 15, 1245. E. H.

Velocity of chemical reactions. JOHN EGGERT. *Z. angew. Chem.* 34, Aufsatzteil 181-3(1921).—A short review is given of the laws governing velocity of reactions together with the theories proposed to explain them. E. N. BUNTING

Kinetic studies of the decomposition of hydrogen peroxide. FR. BÜRKI AND FR. SCHAAP. *Helvetica Chim. Acta* 4, 418-25(1921).—The authors investigated the influence of the different components on each other in the analysis of HCHO by O. Blank and H. Finkenbeiner (*Ber.* 31, 2979; cf. Wolf, *Ann. chim. anal. appl.* 5, 49-55) according to the reaction: $2\text{HCHO} + 2\text{NaOH} + \text{H}_2\text{O}_2 = 2\text{HCOONa} + \text{H}_2 + 2\text{H}_2\text{O}$. The reaction between equiv. amts. of HCHO and NaOH ($2\text{NaOH} + 2\text{HCHO} = 2\text{HCOONa} + 2\text{H}_2$) is of the first order; the const. is $k = 0.00615$ at 40° . Expts. on the influence of alkalis on the decompn. of H_2O_2 proved that this is a monomolecular reaction. The velocity of decompn. increases with increasing concn. of alkali, but not in linear function, the velocity of decompn. increasing more slowly than the concn. of alkali. Different alkalis have a different influence on the decompn., probably owing to their different dissociation. The expts. were carried out with the same amt. of the different alkalis of the same normality (0.05 N) at 40° . The const. are for $\text{NaOH} : K = 0.4343$ $k = 0.000851$; for $\text{KOH} : K = 0.000883$; for $\text{NH}_4\text{OH} : K = 0.000751$; for $\text{Ba(OH)}_2 : K = 0.000427$. The decompn. increases also very rapidly with the temp. But expts. proved that besides acids 90% alc., 1% gelatin soln. or 10% urea stabilize H_2O_2 in aq. soln. The reaction between HCHO and H_2O_2 was investigated in the following way: To 1 mol. H_2O_2 and 1 mol. HCHO were added 0.05 mols. alum; the reaction const. $k = 0.00708$. By addition of the same amt. of Na acetate k is 0.06601 at 40° , and by addition of 0.05 mols. NaCl $k = 0.04317$. Alkalies and chlorides therefore accelerate the decompn. E. FIERTZ

Specific heats of aqueous salt solutions. KARL JAUCH. Rostock. *Z. Physik* 4, 441-7(1921).—J. discusses the data of Heydweiller (*C. A.* 9, 2181) and uses it to get empirical values for the effect of a large number of ions. F. C. HOYT

Some elementary mechanical considerations and their critical significance for thermodynamics. J. GRISSLER. Königshütte. *Z. Elektrochem.* 27, 209-16(1921).—A mathematical and theoretical paper dealing with the conception of energy. The varying nomenclature of energy is discussed and it is pointed out that Nernst's "maximum work" and Helmholtz's "free energy" are transliterations for the concept of "work-potential," and that the thermodynamic quantity TdA/dT is a "kinetic potential." The 2nd law of thermodynamics has the following purport: "changes of latent heat and changes of kinetic potential correspond with one another." An energy scheme is put forward, in which the total energy, U , can be regarded as the sum of the potential and kinetic energies, and equally well as the difference between the work potential and the energy supply.

H. JERMAIN CREIGHTON

The equation of state of nitrogen at small pressures and low temperatures. R. BARTELS AND A. EUCKEN. Techn. Hochschule, Breslau. *Z. physik. Chem.* 98, 70-9 (1921).—The investigation was undertaken to det. at low temps. and small pressures the abs. value of B' in the equation $pv = nRT(1 - B'p)$, and the change in this quantity with change in temp. The equation of state of N has been measured between 76 and 90° abs. and 0.5 and 1.0 atm., using a const. pressure thermometer. The results obtained show that $B' = 0.0022 + 19600/T^2$ (reciprocal atms.) The mol. heat C_p of N at 92° abs., calcd. by means of this equation after reduction to the ideal gas condition, lies very close to the classic value 6.944. A comparison of the change with temp. of the reduced B' values for N and H shows that the two curves diverge at low temps.

H. JERMAIN CREIGHTON

An equation of state for nitrogen at high densities. R. BECKER. *Z. Physik* 4, 393-409(1921).—B. shows that the following equation will fit Amagat's data on the 0° and 15° isothermals for N up to 3000 atm.: $p = (T/273) A(v) - D(v)$ where $A = p(1 + kpc^{k/2})$ and $Dv^2 = a - (K/V^2)$. In reduced units $k = 0.001801$, $a = 0.00250$, $K = 1.34 \times 10^{-11}$ and $\beta = 5$. That the equation holds approx. up to 10³ atm. is shown by the fact that it can be used in calcg. detonation velocities of explosives. The equation is also used to derive provisional values for the repulsion law between the N molecules.

F. C. HOYR

A vapor pressure formula with a general integration constant. F. A. HENGLEIN. Techn. Hochschule, Danzig. *Z. physik. Chem.* 98, 1-13(1921); cf. C. A. 15, 198.—A relation has been established between the coeffs. contained in the mathematical expression of Trouton's rule and the consts. in the equation: $\log T_1 = a \log T_2 + b$, previously proposed for the comparison of the vapor pressure curves of 2 substances. From this new relation the vapor-pressure formula, $\log p$ (atm.) = $(-k/T^m) + 4.6223$, has been derived. Unlike other vapor pressure formulas with 2 sp. consts., this formula holds over a very large temp. range. Moreover the formula is characterized by the fact that the integration const. is the same for all substances. It is shown that the exponent $n = \lambda/p(v-v')$. K where K is a const. having the same value for all substances at the same temp., λ is the mol. heat of vaporization, p is the vapor pressure, and v and v' are the mol. vols. of the substance in the gaseous and liquid states, resp. The function, $\lambda/[p(v-v')]$, can be calcd. for all pressures from the vapor pressure formula; on the other hand, n can be evaluated from $\lambda/[p(v-v')]$ or from (λ/RT) . In order to det. the consts. of the vapor pressure formula, either 2 vapor pressure detns. or a knowledge of a vapor pressure point and the mol. heat of vaporization at the same pressure are requisite. The formula holds also for the sublimation pressure and the decomp. pressure.

H. JERMAIN CREIGHTON

Vapor pressure regularities. VI. W. HERZ. Univ. Breslau. *Z. Elektrochem.* 27, 216-8(1921); cf. C. A. 15, 1647.—Dühring's vapor-pressure formula is an empirical, important aid in the construction of the vapor pressure curves of comparable liquids.

While the assumption of a vaporization null point can be of practical advantage, it is not possible to draw general theoretical conclusions from either the D. vapor-pressure formula or from the doctrine of a vaporization null point. H. JERMAIN CREIGHTON

Aggregation at the melting point. W. R. FIELDING. *Chem. News* **120**, 241-2, 255-6, 302-3; **121**, 87-8, 150-3(1920).—The relationship between melting point and at. wt. has always been a puzzling one. Assuming that at the m. p. the molecules or atoms of each element are aggregated to form "melticules," and the wt. of a melticule being its melticular wt., it can be shown that when m. p. is plotted against melticular wts. all of the elements lie on a single parabolic curve. If a number of elements with m. ps. close together are chosen, the curve is nearly a straight line. Calcs. of the melticular wts. were based upon an erroneous assumption of the melticular wt. of Br, which though corrected in a later paper, renders the 15 accompanying tables of data intrinsically worthless. As the sp. heats of many elements have been detd. at temps. approximating their m. ps., the next step was to connect sp. heats at the m. p. with the m. p. and rate of aggregation at the m. p. If sp. heat $\div R$ is plotted against m. p., all of the elements investigated were found to lie on the same parabolic curve, but if m. p. \times sp. heat be plotted against R , the curve resulting is nearly a straight line. As the sp. heats at m. p. are given for only a few elements, the curve was built up in five sections, ranging from 2 Å. to 3875 Å. Sp. heat \times m. p. = $R \times 6.22$. J. T. R. ANDREWS

The relation between the boiling point in vacuum of the arc cathode and the critical temperature. P. WALDEN. *Z. anorg. allgem. Chem.* **115**, 312(1921); cf. *C. A.* **15**, 2227.—A note pointing out that the data of Hansen (*C. A.* **4**, 2895; **5**, 2351) substantiates the findings in W.'s paper of above title. G. L. CLARK

Polymerization in the solid state. W. R. FIELDING. *Chem. News* **122**, 13-7(1921); cf. preceding abstract.—Elements which have abnormal sp. heats, i. e., those of low at. wts., are the ones which show particularly great changes in degree of polymerization per degree rise in temp. For most elements p (degree of polymerization) diminishes as the temp. increases, and often in the same group as the at. wt. increases. Certain elements, such as C, B, O, and the NH_2 radical, exert a powerful polymerizing effect upon compds. into which they enter. Lowering of temp. produces greater degree of polymerization. At zero abs. a substance should be incapable of aggregation, but with rise in temp. the power to aggregate returns. As examples of polymerization in the solid state may be cited ice, which at its m. p. is mainly trihydrol; NH_4Cl , which at 30° exists as $(\text{NH}_4\text{Cl})_3$; and KCl , which is at ordinary temps. $(\text{KCl})_{1.4}$. The mol. wt. of any substance in the solid state can be calcd. by use of the formula: $P = 9/W/S$, in which P = degree of polymerization; W = formula wt./no. of atoms in the molecule; and S = sp. heat at temp. observed. Then mol. wt. = formula wt. $\times P$. J. T. R. ANDREWS

Properties of mixtures of isopropyl alcohol and water. ROBERT B. LEBO. *J. Am. Chem. Soc.* **43**, 1005-1011(1921).—For isopropyl alc., b. 82.4° , $d_{20} = 0.7855$. A table for sp. gr. of alc.- H_2O mixts. is given. The const. b. p. mixt. has a sp. gr. of 0.8158, boils at 80.4° and contains 87.70% alc. by wt. and 91.00% by vol. Curves showing the b. ps. of the alc.- H_2O solns. and compn. of the evolved vapor indicate that this alc. is more easily rectified than Et alc. G. L. CLARK

Ammonia-carbonic acid compounds in equilibrium with their aqueous solution. ERNST TERRES AND HANS WEISER. *Techn. Hochschule, Karlsruhe. Z. Elektrochem.* **27**, 177-93(1921); cf. *C. A.* **15**, 589.—The conditions of existence of a number of $\text{NH}_2\text{-CO}_2$ compds. in equil. with aq. $\text{NH}_3\text{-CO}_2$ solns. have been studied for the purpose of finding the conditions for the techn. prepn. of the more important of them. In all the expts. the starting materials were NH_4HCO_3 and H_2O . The changes in the solid phase and in the soln. with increasing NH_3 content were investigated at a number of temps. It was found that the 5 $\text{NH}_2\text{-CO}_2$ compds. adduced by Divers (*J. prakt. Chem.*, **105**, 478)

really exist: NH_4HCO_3 , $2\text{NH}_4\text{HCO}_3 \cdot (\text{NH}_4)_2\text{CO}_3 \cdot \text{H}_2\text{O}$, $(\text{NH}_4)_2\text{CO}_3 \cdot \text{H}_2\text{O}$, $\text{NH}_4\text{CO}_2\text{NH}_2$ and $\text{NH}_4\text{CO}_2\text{NH}_2 \cdot \text{NH}_4\text{HCO}_3$. From the soln. curves and the space diagram constructed from them, it has been ascertained that $(\text{NH}_4)_2\text{CO}_3$, $2\text{NH}_4\text{HCO}_3 \cdot (\text{NH}_4)_2\text{CO}_3 \cdot \text{H}_2\text{O}$ and $\text{NH}_4\text{CO}_2\text{NH}_2 \cdot \text{NH}_4\text{HCO}_3$ are only stable in a very definite temp. interval. The first 2 of these compds. are stable around 33° , while the third is capable of existence only above this temp. Both NH_4HCO_3 and $\text{NH}_4\text{CO}_2\text{NH}_2$ have been found to be present, at all temps. studied, in the solid phase in equil. with the corresponding NH_3 - CO_2 solns. Starting with NH_4HCO_3 as the solid phase and increasing the NH_3 content of the aq. soln., the following solid phases make their appearance, in the order mentioned, as the temp. rises from 0 to 30° : NH_4HCO_3 , $2\text{NH}_4\text{HCO}_3 \cdot (\text{NH}_4)_2\text{CO}_3 \cdot \text{H}_2\text{O}$, $(\text{NH}_4)_2\text{CO}_3 \cdot \text{H}_2\text{O}$ and $\text{NH}_4\text{CO}_2\text{NH}_2$. At about 33° the 2nd of these compds. disappears, while at 33° the 3rd compd. vanishes. The $\text{NH}_4\text{CO}_2\text{NH}_2$ field does not border on the NH_4HCO_3 field, however, as these fields are sepd. by the double salt, $\text{NH}_4\text{HCO}_3 \cdot \text{NH}_4\text{CO}_2\text{NH}_2$. The foregoing data give directly the conditions for the prepn. of $(\text{NH}_4)_2\text{CO}_3$ and $2\text{NH}_4\text{HCO}_3 \cdot \text{NH}_4\text{CO}_2\text{NH}_2$. Values adduced from the soln. curves for the soly. of NH_4HCO_3 are in good agreement with those detd. by Dibbitts (*J. prakt. Chem.*, [2] 10, 439). H. JERMAIN CREIGHTON

Low-voltage standard cells. JUICHI OBLATA. *Proc. Phys. Math. Soc. Japan* [3] 3, 64(1921).—An abstract. In measuring a small e. m. f. with a high resistance potentiometer, it is often very convenient if a low voltage standard cell of the order of one-tenth of a volt or less is available. Several cells were set up and their properties studied. The best of these were (b) $\text{Cd amalg. (10\%)} \mid \text{CdCl}_2 \cdot 2.5 \text{ H}_2\text{O} \mid \text{PbCl}_2 \mid \text{Pb amalg. (10\%)} = 0.14186$ volt and (c) $\text{Cd amalg. (10\%)} \mid \text{CdI}_2 \mid \text{PbI}_2 \mid \text{Pb amalg. (10\%)} = 0.09835$ volt. These two cells are the most reproducible and constant of those studied and are well suited for the above described purpose. By combining these two cells there is obtained a standard e. m. f. of 0.2402 volt having a negligible temp. coefficient (0.000045 volt per degree C.). E. P. PHELPS

Sodium-oxygen chains. EMIL BAUR. *Techn. Hochschule, Zürich. Z. Elektrochem.* 27, 194-99(1921).—Three types of chains have been investigated: (1) $\text{Pb-Na alloy} \mid \text{NaOH} \mid \text{O}_2(\text{Ag})$, (2) $\text{Na} \mid \text{NaOH} \mid \text{O}_2(\text{Ag})$ and (3) $\text{Na} \mid \text{NaOH} \mid \text{O}_2(\text{Fe})$. With the first two types of chains a tube of Ag was partially immersed in the molten NaOH, the upper portion being surrounded by an atm. of O_2 . With the third type of chain, a brush anode, consisting of a large number of fine Fe wires, was employed. The end of this electrode touched the surface of the NaOH and the upper part was surrounded by an atm. of O_2 . The Ag and Fe anodes were found to be equiv., but the latter required to be continuously satd. with O. With both kinds of anodes the e. m. f. at 370 – 380° was about 2.2-2.3 v. H. JERMAIN CREIGHTON

The intensity of polarization or the dielectric displacement of a permanent electret. MOTOTARO EGUCHI. *Proc. Phys. Math. Soc. Japan* [3] 3, 2-4(1921); cf. C. A. 14, 3563.—Describes an electrometer method for measuring the intensity of polarization of permanently polarized dielectrics of various shapes. F. P. PHELPS

An American edition of Lavoisier's elementary treatise of chemistry. JEAN LE GOFF. *Répert. pharm.* 33, 97-102(1921).—A brief review of the various editions of Lavoisier's elementary treatise of chemistry, with special reference to the American edition published at Philadelphia in 1799. A. G. DuMEZ

The determination of electric resistance of alloys lead-tin and lead-zinc at high temperatures (KONNO) 9. Tarnishing of metals (TAMMANN) 9. The space significance of the coordination number in polynuclear compounds (REIHLEN) 6. The geometry of the coordination number (HÖRTIG) 6. Strength of atomic linkages in organic molecules (MARTINET) 10. Combination of mineral salts with organic colloids (SCALA) 11A.

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ROBERT S. POSMONTIER

3—SUBATOMIC PHENOMENA AND RADIOCHEMISTRY

GERALD L. WENDT

Structure of the atomic nucleus. E. GEHRCKE. *Sitz. Heidelberger Akad. Wiss., Math.-nat. Klasse* 1919 A, pp. 19; cf. *C. A.* 14, 1925: 15, 2381.—In continuation of the models developed previously for the Li, Be, B, and C atoms (*C. A.* 14, 1925), G. now puts forward structures for the at. nuclei of the other elements to the end of the periodic scheme. The fundamental hypothesis is that the at. nuclei of the higher elements are merely repetitions of those of a lower horizontal series of the periodic system with the difference that the nucleus is surrounded by a ring of α -particles. Thus, for example, the at. nucleus of Na is identical with a Li nucleus surrounded by a ring composed of 4 α -particles, while, similarly, the K nucleus is identical with a Na nucleus surrounded by a ring of 4 α -particles. Isotopes are possible for several atoms which differ from one another by an α -particle in the ring enclosing the central nucleus. The number of α -particle rings is considerable in the case of the higher elements. Every element would thus appear as a compd. of a primal element, H, and electron, arranged according to a systematic and not too complicated plan. Order is thus introduced into the relationship between at. wt. and at. number, and explanations are found for a lengthy series of empirical observations, such as the chem. similarity of the rare earths, the spaces in the periodic system, etc. J. C. S.

Natural systems for the classification of isotopes, and the atomic weights of pure atomic species as related to nuclear stability. WM. D. HARKINS. Univ. Chicago. *J. Am. Chem. Soc.* 43, 1038-60(1921).—H. introduces as a method of classifying isotopes the *isotopic no.* This may be considered as the no. of *neutrons* (formula pe , where p is a H nucleus and e is an electron) present in any isotope in excess of the composition represented for the same element by the no. 0. It is also explty. defined by the following: $n = P - 2N_1 = 2N - P = N - M_1$, where P is the at. wt. or no. of positive electrons in the nucleus, M the at. no. or net nuclear charge, and $N = P - M$, the no. of negative electrons in the nucleus. The isotopic no. is also equal to $2f$, where f represents the no. of cementing electrons in the author's at. wt. equation, $W = P = 2(M + f)$. During α radioactive disintegrations n remains constant but in a β transformation decreases by 2 owing to a decrease of N by 1 and an increase of M by 1. An isotopic no. 0 corresponds to an N/P ratio of 0.5 and represents $1/4$ of all known atoms. The isotopic nos. higher than 0 are represented by 54 hyperbolas when N/P and P are independent variables and 54 straight lines when n is plotted on the y-axis. The composition of any atom is $(p_2e)M(pe)neM$. A second method of classification is into 4 classes according to even and odd nos. of electrons. All abundant species of atoms of isotopic no. 0 belong to Class I (N and P both even). A minimum of abundance is found for isotopic

no. 3 followed by a secondary max. for no. 4. A rational system of nomenclature for radioactive disintegration products is proposed: *e. g.* To which is a meaningless term from the standpoint of classification would be $90_{60}^{230}92$, where 90 is the at. no., 50 the isotopic no., 230 the at. wt., and 92 the at. no. of the ancestor, U. This may be written 90-50-92-5, omitting the at. wt. since it is $2 \times 90 + 50$ and the 5 referring to the position in the U series, or U_iTh_{90} . The no. of isotopes of elements of even at. no. should be greater than those of odd. The at. wts. of the latter isotopes are almost always odd nos. in order to make the no. of negative nuclear electrons an even no. However the values of N/P for Li (7) and B (11) are so high that lower rather than higher isotopes are indicated (6 and 10 resp.). This prediction has had exptl. verification since presentation. It is predicted that the nos. of isotopes are small for elements between He and Co, rise to maxima somewhere between at. nos. 30 and 82, and then fall off again. This contradicts the statement of Aston that the no. of configurations rises with at. no.

G. L. CLARK

Disintegration of atoms by α -particles. F. H. LORING. *Chem. News* 122, 169 (1921).—An abstract of Rutherford and Chadwick's article (*C. A.* 15, 2238). L. refers to Aston's article (*C. A.* 15, 2236).

L. D. ROBERTS

The determination of the elementary electric charge by means of the "shot effect." C. A. HARMANN. *Ann. Physik* 65, 51-78 (1921).—In an earlier paper Schottky (*C. A.* 14, 3581) showed that owing to the irregularities in the emission of electrons from a heated filament, a resonant circuit coupled to a discharge tube operated by a hot wire electron source *in vacuo* should give rise to a mean oscillating current, whose value is given by the equation, $C = \sqrt{2\pi} \sqrt{e i_0} / \tau$, where e is the elementary electric charge, i_0 is the electron current through the discharge tube, and τ is the period of the resonant circuit. If the voltage V and the impedance Z_0 of such a circuit be measured, Schottky shows that the elementary charge is given by, $e = V^2 / i_0 \omega Z_0^2$, where $\omega = 2\pi / \tau$. This theory is based on the assumption that from a hot filament the electrons are emitted completely at random, and that each electron emitted, is emitted independently of the emission of any other. This theory is put to test by H. for a large range of frequencies. The results obtained after very careful work yield values of the elementary charge e apparently corresponding to sub-electrons, (*i. e.*, electrons with a smaller charge than that accepted as a result of other work). This result is not due to errors introduced in measuring the values of the quantities involved in the equation. The values of e obtained appear to vary with the frequency of the oscillating circuit used. Analysis of the results leads H. to propose a qualitative explanation of this apparent variation of e with the frequency, which is based on the thermal inertia of the hot wire cathode. The thermal inertia of the filament will explain the results if one considers that the filament is locally cooled at the point of emission of an electron due to its escape. This cooling incapacitates the particular spot from further electron emission for a certain interval of time. Thus the emission of the electrons from the hot filament would not be entirely independent of the previous electron emission as Schottky had supposed. It is obvious that the frequency of the oscillating circuit would affect the values of e obtained, since different frequencies must interact differently with the thermal lag following the emission of individual electrons.

I. B. LOBB

Remarks on the foregoing work of Hartmann. W. SCHOTTKY. *Ann. Physik* 65, 79-81 (1921).—S. discusses the bearing of the results of Hartmann on his theory as to the upper limit of amplification to be obtained in the amplification of weak currents by thermionic amplifying tubes. This limit is according to Schottky detd. by the initiation and amplification of the feeble oscillations set up in the amplifiers due to the "shot effect." He further states that in his opinion the results of Hartmann furnish no basis for the proof of the existence of a sub-electron. He considers the results rather as

a striking example of a case where one should not place too much reliance on the values of fundamental constants derived from a theory which is based on an obvious, but not experimentally verified assumption. He suggests further expts. to verify the conclusions at which Hartmann arrived in his paper.

L. B. LOEB

On the measurement of the mobilities of gas ions by the method of the toothed wheel. LAPORTE. *Compt. rend.* 172, 1028-1030(1921).—The principle of the toothed wheel is used to det. ionic mobilities. Ions from an external source are driven through two gauze-covered slits in the two opposite insulated metal sides of a rectangular box. The ions are driven to the box, through it, and to a receiving electrode on the opposite side by a series of electric fields of appropriate sense between the source, the two slitted plates, and the receiving electrode. A pendulum bearing two more insulated slotted plates whose slots are identical in size with the slits in the box is suspended above the box in such a manner that the plates of the pendulum can oscillate back and forth just outside of the box, and between the source and box, and between the box and the receiving electrode. The slots in the pendulum are so arranged that when the pendulum is at rest the ions go straight through the box to the receiving electrode. If the pendulum oscillates the ions will only succeed in crossing when the field on the two sides of the box is so great that in the time of transit of the pendulum slots past the slits in the box the ions can get across the box. By detg. the value of the field between the two plates of the box for a given period of oscillation, and a given distance between the plates of the box, at which the ions get across, the mobility of the ions can be obtained. Results obtained in air give values of the mobility which are in agreement with those detd. by other methods. Much work remains to be done in perfecting the theory and application of the method.

L. B. LOEB

Reflection and re-emission of electrons from metal surfaces, and a method of measuring the ionizing potential of such surfaces. R. A. MILLIKAN AND I. G. BARBER. *Proc. Nat. Acad. Sci.* 7, 13-18(1921).—The electrons were liberated from an equipotential surface of Pt coated with BaO and CaO heated by means of a filament. They were accelerated toward the outer receiving copper cylinder (the plate) by means of a const. field applied between the source and a perforated copper cylinder No. 1 placed coaxially, with and between the source and the plate. Between the plate and the perforated cylinder No. 1 was placed a perforated cylinder No. 2 coaxial with the system; the perforations of cylinder No. 2 were larger and corresponded exactly with those on cylinder No. 1. The potential difference between the cylinder No. 2 and the source of electrons was varied from 0 to values much higher than that between cylinder No. 1 and the source. The potential of the plate was maintained the same as that of the cylinder No. 1. Electrons liberated from the source were then driven through cylinder No. 1 and impinged on the plate when the potential of cylinder No. 2 was 0. As the potential on cylinder No. 2 is increased to nearly the value of the potential on cylinder No. 1 the electrons striking the plate if they are diffusely reflected from it, begin to arrive at cylinder No. 2 and the current of electrons to the plate must begin to decrease. When the potential of cylinder No. 2 is equal to that of cylinder No. 1 then any reflected electrons must strike cylinder No. 2 and so be lost to the plate. As the potential of cylinder No. 2 increases beyond the value of that of cylinder No. 1 then if the potential on cylinder No. 1 exceeds the ionizing potential of plate atoms the electrons reemitted from the plate under the bombardment must begin to reach the cylinder No. 2, and the current to plate should show a marked decrease. Thus the difference between the maximum current received by the plate and that received at a given value of the potential of cylinder No. 2 below that of cylinder No. 1 gives the reflected electron current under those conditions. The difference between the current to the plate and the current to the plate when the cylinder No. 2

has a higher potential than cylinder No. 1 gives the value of the secondary emission current due to electrons knocked out of the plate by the bombarding electrons plus the reflected electron current. This divided by the total current gives the number of reflected electrons and of secondary electrons liberated per bombarding electron. With the potential on cylinder No. 2 greater than that on No. 1 the value of the potential on cylinder No. 1 at which the current drops markedly below its value when the potential of cylinder No. 1 is greater than that of No. 2, gives the ionization potential of the plate atoms if the reflected current is small. The results obtained show: (1) The reflection of the electrons from the copper plate used is negligible. (2) It is, therefore, possible to det. the ionizing potential of the plate accurately. (3) The amt. of re-emission of electrons (or emission of secondary electrons) from the plate increases with the velocity of the primary electrons (*i. e.*, with the potential on cylinder no. 1) up to potentials of 300 volts. From this point on it remains const. (4) At this point the number of electrons re-emitted per primary electron never exceeds 1.3. (5) "Cleaning" the surface by heat increases the number of secondary electrons somewhat. (6) The maximum energy of re-emission of the electrons increases from 2 to 5 volts as the potential of the primary electrons is increased from 10 volts to 300 volts. L. B. LOEB

Conductivity and atmospheric ionization in a confined space under conditions of constant temperature and illumination. ROSE STOPPEL. *Nachr. kgl. Ges. Wiss. Göttingen, Math. physik. Klasse* 1919, 397-415.—There seems to be a daily variable affecting the so-called "*plant sleep*," which is independent of temp. changes and changes in light intensity. This might be due to a daily variation in elec. cond. of the air. The ionization of the air in a confined basement room was accordingly studied over a considerable period of time to see whether any variations could be observed which could be correlated with this phenomenon. Const. illumination when used was obtained by the use of two 100-watt elec. lamps. The results obtained are inconclusive and their interpretation is by no means clear. The cond. of the air in the dark indicated a marked daily variation, reaching its max. value between 2 and 4 A. M. With const. illumination in the room this variation became less prominent. The cond. was increased during illumination. The observed daily variation could not be accounted for by variations of temp., pressure or humidity. Measurements of the number of ions per cc. during the winter in the dark also showed as daily variation. In summer these variations were very irregular. The number of ions per cc. appeared to decrease with the const. illumination. The author states that this last result would require that the mobility of the ions was increased as a result of illumination, as the number of ions seemed to be decreased while the conductivity was increased by illumination. L. B. LOEB

Dielectric constant and electric double-refraction. R. GANS. *Ann. Physik* 64, 481-512(1921).—Assuming that the dielectric contains particles with elec. charges which have elec. fields associated with them, the expression for the energy of the system is calcd. when the dielectric is in an elec. field and from this expression the change in the energy of each particle is calcd. It is found that the energy of each particle changes only insofar as the elec. moment of the particle changes and this change is a quadratic function of the induced elec. moment and independent of the permanent moment. The polarization set up in a medium containing N elec. particles per unit vol. is then found. To calc. the elec. double refraction it is assumed that the optical wave gives an impressed elec. force which sets up a polarization with which is associated a change in the index of refraction. The change in the index of refraction which is produced when the elec. vector of the optical wave is parallel to the x -axis and also when parallel to the z -axis is then calcd. The mol. field which is associated with the elec. particle is then introduced and the polarization and energy are calcd. for the case in which the elec. force of the optical wave is superposed on this molecular field. For the case in which the

mols. have no permanent elec. moment there follows the relations, $(\epsilon-1)/(\epsilon+2)(1/D) = A$ and $R = R_0/(1-\alpha D)$, where R is a measure of the Kerr constant; D , the density of the medium; ϵ , the dielec. const.; A , α and R are consts. R depends on the temp. only insofar as the d. does. Where the mols. have permanent but no induced elec. moment and this permanent moment is not essentially changed by the application of an elec. field the dielec. const. can be calcd. by the methods already applied by Gans to the calcn. of the magnetic susceptibility. In this case it is found that $(\epsilon-1)/(\epsilon+2)(T/D) = Q\tau\psi(\tau)$; $R = R_0 P(\tau)$; $\tau = b(T/V_D)$, where T is the abs. temp.; Q , R_0 and b are consts. and $\psi(\tau)$ and $P(\tau)$ are functions which are computed and tabulated. In the case of gases and vapors in which τ is large these functions reduce to constants. When the mols. possess permanent as well as induced moment and the medium can be assumed isotropic, more general equations are obtained. These reduce to the special cases considered earlier. No comparison of the theory with observation can be made at this time on account of insufficient data. To make such a comparison it is necessary to know the dielec. consts. and the Kerr consts. in the same substance at different temps.

ALPHEUS W. SMITH

The calculation of the loss of scattered radiations due to absorption in the scattering media. R. GLOCKER AND M. KAUPP. *Physik. Z.* 22, 201-8(1921).—The scattering of Röntgen rays may give rise to errors in the measurements of intensities by methods of ionization, especially in radiotherapy. To det. the intensity of radiations arriving at a point either in front of or behind a plate on which Röntgen rays are falling, the assumption has previously been made that the scattering coeff. is independent of the azimuth. The expts. of Barkla, Crowther and others have shown that this assumption is only a rough approximation, for the scattering coeff. is a complicated function of the angle between the direction of the primary rays and the direction of the scattered rays. The form of this function depends on the atomic structure and the wave length of the primary rays. The ratio of the intensity of the scattered radiation to the intensity of the primary radiation is calcd. for a number of cases. The first case considered is the case in which the point at which the scattered radiation is detd. lies in front of the plate and on the normal to the plate. Two special cases arise: (1) when the plate is infinitely thick and the solid angle subtended at the point by the plate is 2λ ; (2) when the plate is finite in thickness and the solid angle is small. The second case considered is that in which the point lies on the opposite side of the plate from that which receives the primary radiations. Here again two special cases are considered. The azimuthal distribution of the scattered radiation about the incident primary radiation is calcd. and also the intensity of the scattered radiation in an element of volume inside of the medium through which the scattered radiation passes. A comparison of the theory with the observations of Friedrich and Dessauer shows that the curves obtained by plotting the ratio of the intensities against the thickness of the plate are similar in form but that there is not an agreement between the theoretical and the calcd. values of the intensities.

ALPHEUS W. SMITH

Ionization with waves of high frequency in closed gas volumes. A. BECKER AND H. HOLTJUSEN. *Ann. Physik* 64, 625-45(1921).—Lenard and others have pointed out that the ionization of a gas under the influence of cathode rays is due to free moving electrons. Based on this assumption the authors give a theoretical calcn. of this effect for the case of a cylindrical gas volume, and the influence of the walls is discussed. It is calcd. under what conditions such a gas volume can be considered as having no walls, the loss of ionization from radiation near the walls being exactly compensated by the ionization under the influence of the wall in this particular case. Expts. made with gas volumes having walls of paper, paraffin and aluminium agreed with the calcns.

E. FIERTZ

Röntgen-ray continuous radiations. A. MARCH. *Physik. Z.* 22, 209-213(1921).—The curve showing the distribution of energy in a continuous Röntgen-ray spectrum is similar to the corresponding curve for thermal radiations. There is this difference that the curve for the thermal radiations approaches asymptotically the axis for short wave lengths but the intensity of the Röntgen-ray radiations does not approach zero for short wave lengths. It stops abruptly when a certain minimum wave length has been reached. This wave length is given by Einstein's law $eV = h(C/\lambda_0)$. Ulrey has found that the wave length for which the intensity of the radiation is a maximum is inversely proportional to $V^{1/2}$ but analogy with Wein's displacement law would suggest that it be proportional to V^{-1} . Assume that an electron after N collisions is brought to rest and that its energy ($E_0 = eV$) is imparted to the centers with which it collides. These centers will for the most part be the electrons in the atoms which are being bombarded, since the number of these electrons is large in comparison with the number of positive centers. From the consideration of the entropy of the system and the fact that this energy is distributed among the centers after these collisions M , arrives at a distribution function which describes the way in which the energy is distributed among the bombarded atoms. This function is, $w = (N/E_0)e^{-(NE/E_0)}$. Assume that the bombarded atom can only send out monochromatic radiation of frequency $V = E/h$ when it transforms energy E into radiation. This assumption is necessary in order to account for the fact that a certain potential is necessary to produce characteristic Röntgen rays. From the current in the tube and the function giving the distribution of energy among the bombarded atoms an expression is derived which gives the intensity of the radiations for a particular frequency or wave length. This expression is, $R\lambda = C_1 N^2 \lambda_0 (1/\lambda^3) e^{-N\lambda_0/\lambda}$. It follows from this expression that the wave length at which this intensity has its maximum value is $\lambda_{\max} = N\lambda_0/5$. From this relation together with the empirical relation $V^{1/2}\lambda_{\max} = \text{const.}$ it follows that the number of collisions which are made before the electron is brought to rest is proportional to the velocity of the electron. By the aid of these results an expression for the total energy sent out per second is arrived at. In agreement with observation the total energy is found to be proportional to the current times the square of the potential difference. On the other hand the maximum intensity is proportional to $V^{1/2}$. This result means that the maximum value of the intensity increases more rapidly than the total intensity as the potential difference is increased, and indicates that with increasing voltage a greater part of the total energy is concd. where the wave length has the value for which the intensity is a maximum.

ALPHEUS W. SMITH

Spectrum analysis. ARTHUR W. GOODSPEED. *Univ. Pennsylvania Bull.* 21, No. 18, 207-22(1921).—A discussion of both the visible and the invisible spectra, and their relationship to chemistry, physics, astronomy, and atomic structure.

JOSEPH S. HEPBURN

The origin of band spectra. YUTAKA TAKAHASHI. *Proc. Phys. Math. Soc. Japan* [3] 3, 20-8(1921).—It is possible to deduce a formula representing a system of band spectra from the oscillation of the atoms in a mol. if, with Bohr and Sommerfeld, we accept the quantum relations $A_1 - A_2 = h\nu$ and $\int_L p_i dq_i = nh$ for the conditions of the radiation and the stationary state. A simple Deslandres formula $\nu = A + B(n_1^2 - n_2^2)$ where $B = h/8\pi^2 I_0$ is arrived at. If the angular momentum of the mol. rotation is not a complete multiple of $h/2\pi$ the formula becomes $\nu = A + B(n + \epsilon)^2$ where $\epsilon < 1$ as observed in many cases. The theoretical values of A and B in the last equation are found to be of the same order of magnitude as the observed ones for band spectra of N and O.

F. P. PHELPS

The origin of band spectra. YUTAKA TAKAHASHI. *Proc. Phys. Math. Soc. Japan* [3] 3, 30-3(1921).—Investigating the low potential discharge in hydrogen Fulcher

isolated two triplet bands. It is shown that these bands can be represented by the author's formula given in the preceding abstract by taking suitable values for the constants.

F. P. PHELPS

Photochemistry of lead compounds. CARL RENZ. *Z. anorg. allgem. Chem.* **116**, 62-70(1921).— PbCl_2 was always thought to be stable towards sunlight, differing from PbBr_2 , but under the influence of strong sunlight even PbCl_2 turns from white to gray and black-gray. Especially PbCl_2 which has been prepd. by addition of NaCl or KCl to a soln. of a Pb salt instead of HCl changes its color very rapidly under the influence of sunlight. The gray coloration does not change if treated with HNO_3 ; it consists, therefore, of subchlorides or "photochlorides" and not of metallic Pb. PbO is oxidized to plumbates under the influence of sunlight and in the presence of water, though metallic Pb may first be formed. A sample of PbO which has been under the influence of sunlight does not dissolve homogeneously in dil. HCl ; R. explains this behavior by the presence of isotopes in the Pb; he hopes to sep. the isotopes by dissolving in fractions with HCl the PbO , which has been in the sunlight. Similar expts. are carried out with other photohalides.

E. FIERTZ

Reactions of the photochemical increase in valence of oxygen. R. KÖGEL. *Phot. Korr.* **58**, 65-71(1921).—The theory of this increase in valence has explained many photochem. reactions of org. compds. contg. O. Many structural formulas, for which the original paper must be consulted, are given of the products obtained from acetone and alcohols, benzophenone and alcohols, quinone and aldehydes.

L. DERR

Decomposition of hydrocarbons by canal rays (KOHLSCHÜTTER, FRUMKIN) **10**. **Brightness decrease of radioactive paints** (BERNDT) **26**. **Gaseous hydride of thorium** (KLAUBER, MELLENEHEIM) **6**. **An analysis of molecular volumes from the point of view of the Lewis-Langmuir theory of molecular structure** (PEASE) **2**.

GRAETZ, L.: *Die Atomtheorie in ihrer neuesten Entwicklung*. Stuttgart: J. Engelhorns Nachf. M 7.50. For review see *Umschau* **25**, 385(1921).

ПЛОТНИКОВ, И.: *Allgemeine Photochemie*. Berlin and Leipzig: W. de Gruyter & Co. 730 pp. M 140. For review see *Kolloid. Z.* **28**, 308(1921).

4 -ELECTROCHEMISTRY

COLIN G. FINK

Indirect arc (Volta) furnace. ANON. *Metal Ind.* **19**, 191-2(1921).—A description of a 3-phase, gyrating, elec. melting furnace for brass and metals, developed by the Volta Mfg. Co. Ltd. of Welland, Ont. Capacities of $\frac{1}{2}$ to 1 ton, voltage and frequency to suit. The three-phase feature assures a well balanced load. The furnace is cylindrical, with up and down axis and sep. top. Three electrodes are spaced at 120° around the shell, and require less careful alignment than for single-phase. Since the electrodes are always above the bath, breakage is avoided, and the heat is "sprayed" down evenly over the whole metal surface. An efficient stirring is given by a simple gyrating movement, accomplished by means of a ring revolving on rollers on top of which ring is mounted another set of rollers at different heights so as to incline the furnace to pour.

CHAS. H. ELDRIDGE

Production of iron by direct electrothermic reduction of the ore. (Levoz process.) MARCEL GUÉDRAS. *Technique moderne* **13**, 264-5(1921).—Description of the Levoz process. The essential point of the process consists in the formation of ferro alloys in the reaction mass, which purify the Fe. It comprizes 3 distinct stages. (1) The

oxides of Fe and other easily reducible metals (Mn) are reduced by C. The furnaces are so designed (details not given) that the Al silicates of the ore react with the Fe_2O_3 in the presence of the C to give ferro-Si and Al_2O_3 , which latter dissolves in the cryolite flux which is added to the charge. (2) The Al_2O_3 dissolved in the flux prevents the volatilization of the Al and also the oxidation of the Fe in the crucible. The Fe absorbs the Al reduced by the C in the bath ($\text{Al}_2\text{O}_3 + 3\text{C} = 2\text{Al} + 3\text{CO}$), forming ferro-Al and eliminating at the same time the FeC_2 . With the ferro-Si formed in stage (1) the Al forms a ferro-silico-Al, which is a powerful reducer and which gives rise to strongly exothermic reactions. At the end of the 2nd stage the mass consists of a layer of slag over a complex ferro-alloy consisting of ferro-silico-Al and ferro-silico-Mn dissolved in Fe. (3) The molten mass flows into an elec. furnace contg. a charge of the ore to be reduced. The strongly reducing, complex ferro-alloy reacts with the oxides in the ore with great evolution of heat, so that the greater part of the heat absorbed in (1) and (2) above is recovered and the current consumption is very small. The slag, consisting of double silicates and of cryolite, has a very low m. p. and is easily sep'd. from the metal. The silico-Al, silico-mangano-Al, and silico-Ca-Al carry the metallic oxides and sulfides into the slag with formation of very fluid silicates of Fe and Al and complete elimination of these impurities. There remains a very pure Fe which may be either drawn off as such or converted into steel. The cryolite reacts with the CaO of the charge to form CaF_2 and $\text{Al}_2\text{O}_3\text{Na}_2$; but this does not interfere with the main reactions. The process is carried out in a reduction furnace with inclined hearth, emptying into a crucible for the 2nd stage and an elec. furnace for the 3rd, the molten metal flowing from one to the next by gravity. The advantages of the process are: Any kind of ore can be treated. The cost of the plant is much less than that of a blast furnace, and the product obtained is pure Fe or steel. There is an important saving in fuel. Reducing gases having a high calorific value are utilized. By suitable combination of furnaces, any grade of Fe or steel can be obtained. The consumption of elec. energy is reduced to a minimum owing to the strongly exothermic reactions of the alumino-alloys in the 3rd stage. Cost of labor is low.

A. P.-C.

Electrolytic and electrothermal metallurgy of ferro-nickel. JEAN ESCARD. *Industrie chimique* 8, 53-6, 168-72(1921).—Review of the various methods used for the production of ferro-Ni in the elec. furnace both from garnierite and from nickeliferous pyrrhotites, of the method of producing electrolytic ferro-Ni, and of its properties and use.

A. P.-C.

Soederberg continuous electrode. R. DURRER. *Stahl u. Eisen* 40, 1599-1603 (1920).—The electrode is formed in sheet-Fe forms which are added in sections as the electrode is used up. The same mixt. and method of treatment are used as for ordinary electrodes. The Fe shell carries most of the current in the upper part where the C mixt. is still soft. Installations of continuous electrodes in Norway and Alabama are described. For the Alabama ferro-Mn furnace with electrodes 813 mm. in diam., carrying 20,000 amp., the sheet-iron forms are 1.05 mm. thick and 115 mm. long and weigh 5.6 kg. for 100 kg. of electrode. On the av., a section is added once in 2.5 days; this takes two men about 8 hours. The electrode consumption is 28.3 kg. per ton of ferro-Mn against 63.6 with ordinary electrodes. At present these electrodes appear to have no disadvantages over the ordinary electrode and can be used in any furnace with vertical electrodes that do not have to stand much strain. Cf. J. W. Richards (C. A. 14, 3018).

M. KNOBEL

Radiographs of carbon electrodes for steel furnaces. R. HADFIELD AND S. A. MAIN. *Trans. Faraday Soc.* 15, Pt. 2, 76-81, 82-8(1920); *Science Abstracts* 23A, 438.—Reproductions are given of radiographs of electrodes up to 20 in. diam. taken in the hope of discovering the cause of the fractures occurring, especially with amorphous carbons.

The examn. of amorphous and graphitic electrodes from several makers proved of considerable technical interest, and it is suggested that the X-rays would be useful in controlling the manuf. of the electrodes, as to compn., baking temp. etc. H. G.

Refractories for electric furnace. R. M. HOWE. *Chem. Met. Eng.* **23**, 1215-8 (1920); *Foundry* **48**, 911-3.—Several tables have been compiled from various sources giving the phys. and chem. properties of refractory bricks. Tables are shown of the analyses of refractory raw materials, behavior under load of 50 lbs. per sq. inch, fusion points of refractory bricks, specific heats, thermal conductivity at 1000°, electrical resistivity, sp. gr. of refractory bricks. In magnesia brick a low lime content is desirable and the Fe_2O_3 content should be 4.0-8.5% to facilitate sintering of the brick in firing. Dolomite is undesirable as a refractory, because of tendency to slake, especially if the CaO content is high. The value of zirconia as a refractory depends upon its purity, a suitable bond and complete shrinkage in firing. Refractories should be protected from rain and frost during storage. The cement used in laying up the brick should be similar in composition to the brick. Furnaces should be constructed so that heat will be conducted away from hotter portions and high insulation should be avoided. Heating and cooling of furnaces should be gradual so as to minimize spalling losses, especially with SiO_2 and MgO linings. O. A. HOUGEN

The electric smelting of tin. HANS KREBS. *Metall u. Erz* **18**, 12-13 (1921).—The principal difficulty in the smelting of Sn is that the reduction temp. is so much higher than the m. p. This causes a vaporization loss of 8-9% in reverberatory-furnace smelting and 5-7% in shaft-furnace smelting. Further, this high temp. of reduction makes a slag high in Sn since at high temp. Sn forms both base and acid-forming oxides, giving such compds. as $\text{SnO} \cdot \text{SiO}_2$ and also $\text{CaO} \cdot \text{SnO}_2$. Elec. smelting may be accomplished by using the ore mixed with coal as a resistor; usually no flux is necessary. The vaporization loss is much cut down by this method, since only as much gas is present as is formed from the reduction of the SnO_2 ; further, the gases are no higher in temp. than the actual temp. of reduction. Since the time of the reaction is very considerably shortened the Sn content of the slag is less. The process may be made nearly continuous by adding Sn ore and coke to the melt as Sn is drawn off from the bottom. Expts. have shown that in this way the total loss in Sn smelting can be reduced to 6% even on lab. scale. R. S. DEAN

Ozone. ALBERT CLARKE. *Breuna* May 1921; *Elec. World* **78**, 81 (1921).—A detailed review. C. G. F.

The Hybinette process for separating copper from nickel. ANON. *Elektrochem. Z.* **27**, 61-63 (1921).—In the hydrometallurgical sepn. of Cu and Ni by electrolysis in a diaphragm cell containing acidulated NiSO_4 soln. with crude Cu-Ni anode, the concn. of the Cu dissolved from this anode is kept down by circulating the anolyte through an external tank in which the Cu is pptd. by cementation on a partly used anode taken from an electrolytic cell. The preliminary use of the anode in an electrolytic cell is essential as it gives the plate a peculiar surface which causes a spongy, in distinction from a dense, deposit of Cu to form, thus maintaining the pting. efficiency of the plate. Special means is provided for preventing local high concn. of the Cu in the anolyte, which would cause an impure ppt. of Ni to form owing to penetration into the cathode compartment of the cell by the soln. if high in Cu. LLORA C. KRUEGER

"Slip-lines" and twinning in electrodeposited iron. W. E. HUGHES. *J. Iron and Steel Inst.*, Adv. copy No. 7, 16 pp. (1921); cf. *C. A.* **14**, 2446.—Photomicrographs are shown of etched sections of electrodeposited Fe, deposited under various conditions. They exhibit certain peculiar lines or markings that appear sometimes, and especially at low magnification, as wave-like lines running through the mass of the metal, and sometimes, on individual grains, in herring-bone arrangement. It is suggested that

these lines are "slip-lines," which are produced in the grains of which the deposit is composed by the forces of contraction that act in it during its formation. Also in *Electrician* 86, 717(1921); *Engineering* 111, 583.

V. O. HOMERBERG

Treating an Edison battery that has decreased output. F. A. REIBERT. *Elec. World* 77, 1431-2(1921).—Failure of a battery to give its normal amt. of work indicates that renewal is needed. Electrolyte reading below 1.140 (density) is removed by discharging the battery completely by short-circuiting, pouring out half of the soln., immediately filling with standard renewal soln., and charging for 12 hrs. The battery output is detd. by connecting it across a suitable adjustable resistance and inserting an ammeter in series with it. The circuit is closed and the rheostat set to give the same current as the normal charging one. Discharge is continued at this rate for 5 hrs., after which time each cell should have a voltage of 1. A cell which has dropped below 0.97 v. may be brought up to voltage by removal from the battery, charging 15 hrs. at the normal rate, discharging at the normal rate to 0.5 v. It is then charged 12 hrs. at normal rate and discharged to 1 v.; charged 7 hrs. and discharged to 0.5 v. It is again charged 12 hrs. at normal rate and discharged at normal rate for 5 hrs. with readings taken as before.

W. H. BOYNTON

Revolving box for prolonging life of Edison cells. F. A. REIBERT. *Elec. World* 77, 1168-9(1921).—A wooden box of sufficient size to accommodate the largest tray used with Edison batteries has flanges holding two shafts. The shafts are supported in hangers bolted to the floor. On one shaft is a pulley, through which the box is driven by a motor. Half the soln. is poured off, the cells are placed in a tray, wooden pieces are laid across the top of it and the tray is securely fastened to Fe pipes extending the length of the box on each side of the tray. The box is revolved for 10 min. at 50 r. p. m. After removal of the tray from the box the electrolyte is poured out and renewal soln. added. This treatment often washes out and loosens the short-circuiting material and puts the battery back in good condition.

W. H. BOYNTON

Tray for hydrometer, thermometer and syringes used in battery work. A. SREIN-
AUS. *Elec. World* 78, 76(1921).—Illus. description.

C. G. F.

Electrostatic precipitation applied to blast-furnace gases. H. J. BUSH. *Chem. Age* (London) 4, 116-7(1921).—A brief description of the development of the Cottrell process as applied to blast-furnace gases. An installation nearing completion consists of six compartments of 64 pipes each. Each compartment may be isolated for inspection or repair, and each is connected to a 25-kv. a. generating set. Hammers arranged on a rocking shaft and operated by a single motor dislodge dust adhering to the inside of the pipe electrodes. A secondary gear agitates the discharge electrodes suspended from insulated bus-bar supports. The dust collects in steel hoppers and is discharged into a box through a luted valve. A balanced outlet flap enables the operator to empty the dust whether the compartment is working or not. The generating set consists of a motor-generator, mechanical potential rectifier, transformer and necessary insulators, and has a simple hook switch in the high-tension line. Any single set may be connected to any one of the six precipitator compartments. An automatic tripping gear consists of a pressure gage and a secondary circuit. It closes when the gage registers a min. and, being connected with the no-volt release coils of the circuit-breakers, causes the latter to drop out on all sets. In Germany an efficiency of 99.9% for gas-cleaning plants is claimed in prepg. gas for use in engines without further treatment, but the necessity and economy of so high a purity in English practice is questioned. A list of ten recent English installations is given.

W. H. BOYNTON

Voltage and current harmonics caused by corona. F. W. PECK, JR. *J. Am. Inst. Elec. Eng.* 40, 455-61(1921).

C. G. F.

Triode valve detector. ANON. *Electrician* 86, 724-5(1921).—A triode valve of an

entirely new design is employed, which is of great sensitiveness and robust constitution. "The anode and grid electrodes are made in the form of hollow hemispheres supported so that they are concentric with each other, and are constructed of Ni. The filament is made of 2.4 mils pure drawn W wire bowed into the form of a semi-circle, and concentric with the other electrodes. The bulb is so exhausted that there is a slight trace of gas left, and in such a manner that this triode may be said to function as a soft valve. When used as a detector in conjunction with a receiver there is a total absence of the usual parasitic and microphonic noises; neither does the triode tend to produce noises due to a. c. induction. These faults are generally experienced with the usual well known type of French valve. The characteristic curves are of the general type where a triode of a soft tendency is employed." An alternative cryst. detector is provided for emergency use and consists of a revolving drum carrying eight pairs of crystals mounted in ebonite cartridges. The app. is illus.

W. H. BOYNTON

A new arc lamp for projection apparatus. LUX. *Elektrotechn. Z.* **42**, 601(1921); illus.—Brief description of a new German arc lamp. The upper C electrode is in horizontal position at an angle of 120° with the lower. Max capacity, 80 amp. The new 70-amp., 50-volt, d. c. lamp has a c. p. of 36,000 hefners vs. 26,000 for the old lamp with C electrodes in rectilinear position.

C. G. F.

Manufacture of tungsten filaments for lamps. A. OHSTEIN. *Ingeniören; Elec. Rev.* **79**, 60(1921).—A brief review of the various processes.

C. G. F.

Graphic demand meter recording KVA. ANON. *Elec. Rev.* **79**, 31(1921).—Brief illus. description.

C. G. F.

Relative thermal efficiencies of electric and fuel-fired furnaces (COLLINS) **9**. Relative economy of oil, gas, coal and electric heated furnaces (MOULTON, LYMAN) **9**. The electrical heat treatment of steel (MACDONALD) **9**.

Electric arc furnace adapted for making calcium carbide. E. APPELBY. U. S. 1,374,802, Apr. 12.

Rotary electric arc furnace adapted for melting metals. W. K. BOOTH and W. L. MORRIS. U. S. 1,376,072, Apr. 26.

Electric resistance crucible-furnace. C. SONCINI. U. S. 1,375,615, Apr. 19.

Electroplating apparatus. F. T. TAYLOR and W. F. HALL. U. S. 1,376,052, Apr. 26. The app. has a rotating foraminous container in the plating vat.

Electrodeposition of copper. F. S. WOODWARD. U. S. 1,374,541, Apr. 12. In the electrodeposition of Cu from an acid bath such as CuSO₄ and H₂SO₄ soln. with an anode of Pb or other material insol. in the bath, the liberated acid is neutralized and the bath restored to normal strength and condition by adding an oxide or carbonate of Cu. CaO or CaCO₃ may be used also if mere neutralization is desired.

Electrode for coating carbon steel with alloy steel. O. L. MILLS. U. S. 1,376,963, May 3. An electrode adapted for coating carbon steel with alloy steel is formed of a low-C steel core of high m. p. wrapped with tape, the inner surface of which is coated with an alloying material such as Mn, Ni, Co, Cr, V or W mixed with linseed oil as a binder.

Electrolytic cell. H. I. ALLEN and K. R. FOX. U. S. 1,374,976, Apr. 19; cf. C. A. **15**, 33,992. Anodes of an electrolytic cell adapted for electrolysis of saline solns. are formed of one or more flat C plates having spaced parallel ribs of C on them. The faces of the ribs and the faces of the plates between the ribs are active.

Electrolytic cell adapted for producing chlorine and caustic soda from salt. J. M. WILLIAMS. U. S. 1,376,495, May 3. Structural features.

Bromine from natural brines. H. H. DOW. U. S. 1,376,610, May 3. Natural

brine containing Br is electrolyzed and any gases which are not absorbed by the brine are drawn off by drawing air through the electrolytic app. The adsorbed gases are then recovered from the brine by use of a Br-fixing agent, e. g., Fe, or other suitable reagents.

Electrolytic production of chlorine solutions. M. G. SLOCUM. U. S. 1,376,471, May 3. A soln. of NaCl is subjected to electrolysis, with anodes surrounded with Cl under pressure, in order to displace from soln. the O liberated by electrolysis.

Electrolytic manufacture of stencil or die plates. G. E. WERTHEIMER. U. S. 1,376,385, Apr. 26. Stencil or die plates are formed of metal sheets by coating the sheet with Pb foil, removing the Pb foil in portions to produce the desired design and then electrolytically removing metal from the exposed surfaces of the Pb-coated sheet.

Electrolyte for preparing stencil plates or the like. G. E. WERTHEIMER. U. S. 1,376,366, Apr. 26. A soln. adapted for electrolytically removing portions of a metal plate, in forming dies or stencils, is prepd. from H_2SO_4 80, HNO_3 20, NH_4Cl 200, H_2O 698 and iodine 2 parts. U. S. 1,376,367 relates to a soln., for similar use, formed of H_2SO_4 80, HNO_3 20, NH_4Cl 200, $\text{Cu}(\text{NO}_3)_2$ 5 and H_2O 695 parts. U. S. 1,376,368 specifies a soln., for like uses, formed of H_2SO_4 80, HNO_3 20, NH_4Cl 200, HOAc 2 and H_2O 698 parts. U. S. 1,376,369 specifies a soln., for the same uses, formed of H_2SO_4 80, HNO_3 20, I 2, $\text{Cu}(\text{NO}_3)_2$ 5, HOAc 2 and H_2O 891, with or without NH_4Cl 200 parts.

Metallic sodium. A. W. SMITH and W. R. VEAZEY. U. S. 1,375,330, Apr. 19; cf. C. A. 14, 1266. A fused mixt. of Na_2CO_3 and NaCl and KCl in such proportions as to give the mixt. a m. p. lower than that of its constituents is electrolyzed in order to produce Na. A mixt. of Na_2CO_3 43.5, NaCl 23.2 and KCl 33.3 (m. 565°) may be employed.

Electrolytic production of arsine, phosphine and stibine. H. BLUMENBERG, JR. U. S. 1,375,819, Apr. 26. In producing a mixt. of O and AsH_3 (suitable for fumigating citrus trees), a magma is formed of As_2O_3 with a 10% soln. of H_2SO_4 to which is added about 5% of K_2SO_4 . This magma is introduced into a tank provided with a gas-tight cover, a C cathode coated with Hg horizontally disposed near its bottom and a C anode above the cathode. On electrolysis, K liberated in the Hg reacts with the H_2O to produce H in nascent form which combines with As to form AsH_3 which passes out of the cell with O and uncombined H. PH_3 or SbH_3 may be similarly formed.

Electrolytic fixation of nitrogen. C. B. JACOBS. U. S. 1,376,207, Apr. 26. In the electrolytic fixation of N, porous electrodes are employed and the N is forced through the pores of the electrodes. For the anode, porous graphited petroleum coke is suitable for use with acid electrolytes and fine steel wool, rammed into position in the electrode compartments, gives good results for both electrodes when NaOH or other alk. electrolytes are employed. The electrolytic cell may be formed of glass with an inner container of unglazed earthenware. The porous material is packed within the inner container and between it and the outer wall of the cell. The electrode compartments are supplied with an aq. soln. of HNO_3 , NaNO_3 , NaOH or other suitable electrolyte and N is forced through the electrodes from the bottom. The current is so regulated that the O liberated on and within the porous structure of the anode is sufficient to oxidize the introduced N only to NO. NH_3 is produced at the cathode. The NO produced is oxidized and absorbed to obtain HNO_3 .

Electric battery. D. PEPPER. U. S. 1,375,012, Apr. 19. Structural features.

Electric dry cell batteries. A. H. HAEFELÉ. U. S. 1,377,126-7-8, May 3. Structural features of battery terminal.

Dry cell electric battery. H. W. JONES. U. S. 1,376,627, May 3. Structural features.

Dry cell electric battery. C. HAMBURCHEN. U. S. 1,375,632, Apr. 19. Structural features.

Dry cell electric battery. R. C. BENNER and H. F. FRENCH. U. S. 1,375,202, Apr. 19. A Zn container electrode is provided with a uniform coating of flour paste on the inside and bottom extending only to within a short distance of the open end of the can, leaving an uncoated upper edge, and a seal is placed at the upper end of the can adjacent to the uncoated edge. The paste is cooked on to the surface of the Zn.

Rechargeable dry cell electric battery. H. R. DAM. U. S. 1,377,060, May 3. Structural features.

Electric battery jar. H. DEAN. U. S. 1,376,923, May 3. The jar is especially adapted for storage batteries. It is constructed so as to avoid danger of spilling the electrolyte.

Zinc electrodes for dry cell batteries. L. MAISEL. U. S. 1,375,305-6, Apr. 19. Structural features.

Protecting battery anodes. H. R. PALMER. U. S. 1,376,034, Apr. 26. Anodes of dry cell batteries which may be formed of Zn are protected while the battery is inert by a protective coating of material which is dry after its application and which is impervious to moisture while the battery is inert but penetrable by the electrochemical action of the battery materials when the battery is in use.

Copper sulfate for batteries. D. L. HUMPHREY and C. L. PITTMAN. U. S. 1,375,513, Apr. 19. A material suitable for use in batteries, composed of CuSO_4 containing Fe and mixed with some uncrystallized earthy calcareous residues, is obtained by crystn. from a soln. made by the action of hot 50% H_2SO_4 on crude Cu ore.

Battery depolarizing material. R. C. BENNER and H. F. FRENCH. U. S. 1,375,647, Apr. 19; cf. C. A. 14, 501. A high-voltage depolarizer for elec. batteries is prepd. by forming Cu_2O electrolytically, oxidizing it to CuO and mixing the latter with S.

Photoelectric cell. T. W. CASE. U. S. 1,376,604, May 3. A heatable electrode, which may be formed of metal, is coated with SrO , BaO or CaO and enclosed in an evacuated vessel together with a second electrode, which may be formed of plate Ni. The first electrode is heated by a high-potential current to throw off the coating material and connect the electrodes in an elec. circuit with deposition of volatilized material on the second electrode. This serves to produce a cell of uniform action.

Photoelectric cell. T. W. CASE. U. S. 1,376,605, May 3. A photoelectric cell is formed with a coating of Ba on an electrode of plate Ni. U. S. 1,376,606 relates to a similar cell with an electrode coated with Sr instead of Ba.

Storage battery. M. O. SMITH. U. S. 1,376,171, Apr. 26. Structural features.

Storage batteries. C. W. HAZELETT. U. S. 1,376,143-4, Apr. 26. Structural features.

Storage battery. J. J. FLOOD. U. S. 1,375,654, Apr. 19. Structural features.

Storage battery. T. R. COOK. U. S. 1,376,257, Apr. 26. Structural features.

Storage battery. J. H. MURPHY. U. S. 1,376,566, May 3. Structural features.

Storage battery. N. D. STURGES. U. S. 1,376,905, May 3. Structural features.

Storage batteries. B. FORD. U. S. 1,376,927-8-9, May 3. Structural features. Cf. C. A. 15, 990, 1464.

Storage battery. S. R. GUY. U. S. 1,377,148, May 3. Structural features.

Storage battery. C. D. GALLOWAY. U. S. 1,376,932, May 3. Structural features. Cf. C. A. 15, 1464.

Storage-battery electrolyte. W. GARDINER. U. S. 1,374,916, Apr. 19. An electrolyte for storage batteries is formed of H_2SO_4 soln., Na silicate, powdered soapstone and plaster of Paris.

Storage-battery plates. J. M. PETERSON. U. S. 1,375,317, Apr. 19. A plate of Pb from which the main portion of the total active material of the plate is to be derived is initially treated with sufficient paste of active material such as PbO_2 to provide for sufficient electrical capacity of the battery when first formed.

Storage-battery plate. E. W. SMITH, C. D. GALLOWAY and C. ARMERUSTER. U. S. 1,374,477, Apr. 12. Structural features.

Storage-battery plates. R. N. CHAMBERLAIN. U. S. 1,376,920, May 3. Structural features.

Storage-battery separators. W. BEST. U. S. 1,375,550, Apr. 19. Storage battery separators are formed of slate with longitudinal grooves in its face.

Storage-battery separators. W. M. STUDEBAKER and H. J. EPPLER. U. S. 1,375,740, Apr. 26. Storage-battery separators are formed of groups of strands of spun glass, woven together, some of which at least are plaited.

Storage-battery separators. T. A. WILLARD. U. S. 1,375,763, Apr. 26. Separators are formed by slicing material such as laminated blocks containing rubber-coated cloth or other porous material in such a manner that the slices have uneven surfaces to form spacing projections.

Storage-battery container. H. E. HUNT. U. S. 1,374,506, Apr. 12. Structural features.

Electrodeposition of iron. A. T. C. ESTELLE. Brit. 159,906, March 27, 1918. Smooth Fe deposits are obtained from a slimy suspension of Fe compds. in caustic alkali soln. Compds. of Fe with O and H may be employed. The liquid may contain 30% of $\text{Fe}(\text{OH})_3$ and 70% of a 50% NaOH soln. Oxides may be hydrated by heating with an alkali hydroxide or carbonate to form a ferrite, which is then hydrolyzed. Calcined $\text{Fe}_2(\text{SO}_4)_3$ may, for instance, be heated to 100–120° with about 4 times its wt. of 70% NaOH for 2–3 hrs. in a rotating iron drum with Fe rollers. Sufficient H_2O to reduce the NaOH to 50% strength is added after cooling, and the mixt. can be electrolyzed directly or allowed to stand and the clear soln. removed from the concd. suspension. Oxide which has been more strongly heated requires more concd. or anhydrous alkali and higher temps. Magnetite gives the corresponding hydroxide if moderately heated with a 60% NaOH soln., but more energetic treatment causes oxidation. If soda ash is used, the temp. must be raised above 840°; any undecomposed carbonate is afterwards removed by sepg. and concg. the soln. During electrolysis, the electrolyte is preferably heated to 100°. A current density of 3 amp. per sq. dm. is suitable. The electrolyte may be replenished with the Fe compd. either inside or outside the electrolyzing tank. O is evolved at the anode. Certain metals such as Cd are deposited as alloys with Fe when their oxides or hydroxides are added. Other metals such as Ni are not pptd. under similar conditions.

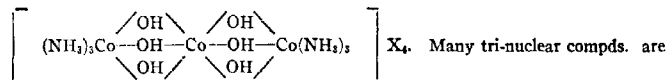
6—INORGANIC CHEMISTRY

H. I. SCHLESINGER

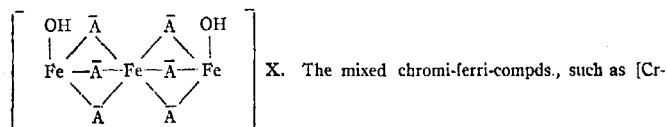
The geometry of the coordination number. GUSTAV F. HÜTTIG. *Z. anorg. allgem. Chem.* 114, 24–6(1920).—As a contribution to the problem of isomerism in coordinated compds., H. has calcd. the limiting radius of each of n spheres surrounding and in contact with a central sphere of unit radius, for the cases where n is 3, 4, 5, 6, 8, 12, or 20. When $n = 5$ the limiting radius is the same as when $n = 6$, namely, 2.414, but the disposition of the spheres in the former case is indeterminate. When n is 8, there are two possibilities; if the spheres are situated at the corners of a cube, $r = 1.366$, but if at the corners of an archimedean antiprism, $r = 1.549$. For higher values of n the number of possible solns. of the problem becomes greater, and a new kind of isomerism becomes a possibility in such cases. J. C. S.

The space significance of the coordination number in polynuclear compounds. HANS REINLEN. *Z. anorg. allgem. Chem.* 114, 65–89(1920).—A theoretical paper, in

which the spatial arrangements in coordinated compds. contg. several nuclei are discussed, and also the relationship between the coordination number and the possible spatial arrangements. In tri-nuclear compds., if each nucleus preserves the octahedral form, the minimum coordination number is 12. In such compds. it must be supposed that two outer octahedra are each combined with the middle octahedron in such a way that the last shares one of a pair of parallel faces with each outer octahedron. Six groups then form "bridge linkings" between octahedra, as in the compd:



known, however, with the coordination number 8, prominent among these being the red ferri-salts of org. acids of the general formula $[\text{Fe}_3\bar{\text{A}}(\text{OH})_2]\text{X}$, where $\bar{\text{A}}$ is a fatty acid group. In such cases R. proposes to represent the middle nucleus of the chain by an octahedron and each of the two end nuclei by a tetrahedron, the combined geometrical form being an elongated rhombohedron. In other words, the central nucleus has a coordination number 6 and each of the end nuclei 4, as represented by the formula:



$\text{Fe}_2(\text{OAc})_4(\text{OH})_2][\text{Cl}_6\text{H}_4\text{O}]$, are of interest because they should show isomerism, in which the difference is caused by the substitution of Fe for Cr in the central nucleus. Such isomerism has not been observed, however, probably because Cr has much less tendency than Fe to form nuclei of the tetrahedral type. R.'s theory is also supported by the properties and compn. of the complex ferri-benzoates. Many of the compds. prepd. by Weinland and his collaborators are discussed from R.'s point of view, and in some cases modified formulas are suggested. Compds. with the coordination number 10, for example, $[\text{Cr}_3(\text{OAc})_6\text{SCN.H}_2\text{O}(\text{OH})_2]$, can be represented spatially by means of a chain of two octahedra and a tetrahedron. A number of trichromiacetate compds. appear to have the coordination number 11, for example, the pyridine compd. $[\text{Cr}_3(\text{OAc})_4(\text{C}_5\text{H}_5\text{N})_2(\text{OH})_2]\text{I}$. The constitution of these substances can be explained geometrically by supposing three octahedra to be joined so as to have one edge common to all three. Between the two outer octahedra there is then an acute angle of about 33° , and by a slight distortion the faces of the two octahedra thus sepd. can be brought into contact so that the three octahedra form a solid figure having 11 points. Geometrically, these 11 points fall into three groups of six, three, and two points resp., corresponding with the chem. character of the compds. of this class. Complex coordinated compds. contg. 4 nuclei are discussed from a similar point of view, and geometrical structures of the same type are suggested for them. The nature of the "bridge linking" combining the several nuclei in the mol. is also discussed.

J. C. S.

Basic exchange in silicates. III. E. RAMANN AND H. JUNK. *Z. anorg. allgem. Chem.* **114**, 90-104(1920).—In continuation of previous work (*C. A.* **11**, 2174; **14**, 256), the formation of Mg permutite by the action of Mg salts on NH_4 , Na, and K permutites has been studied. As in other cases, the reaction is ionic, and there is no evidence of physical adsorption. Pure Mg permutite could not be obtained, not more than half of the bases present in the original permutite being displaced by Mg. The whole of the NH_4 in NH_4 permutite could not be displaced by treatment with carnallite or kainite

solns. Mixed salt solns. decompose the permuto to some extent, especially solns. contg. Mg or NH_4 . This observation may have some bearing on the decompn. of natural silicates, which cannot always be adequately accounted for by the action of water and H_2CO_3 .

J. C. S.

Compounds of hexamethylenetetramine with complex metallic salts and acids. PRIYADARANJAN RAY AND PULIN VIHARI SARKAR. *J. Chem. Soc.* **119**, 390-6(1921).—The following new compds. of hexamethylenetetramine (*Hmt*) with complex metallic salts are described: with Na nitroprusside, $\text{Na}_2\text{Fe}(\text{CN})_5(\text{NO}) \cdot \text{Hmt} \cdot 11\text{H}_2\text{O}$, pale brown, easily sol.; with K ferricyanide $\text{K}_3\text{Fe}(\text{CN})_6 \cdot \text{Hmt} \cdot 9\text{H}_2\text{O}$, golden-yellow; with K cobalticyanide, $\text{K}_3\text{Co}(\text{CN})_6 \cdot \text{Hmt} \cdot 6\frac{1}{2}\text{H}_2\text{O}$, white; with Na cobaltinitrite, $\text{Na}[\text{Co}(\text{NO}_2)_4(\text{H}_2\text{O})_2] \cdot 3\text{Hmt} \cdot 6\text{H}_2\text{O}$, yellow ppt.; with hydroferrocyanic acid, $3\text{H}_4\text{Fe}(\text{CN})_6 \cdot 4\text{Hmt} \cdot 13\text{H}_2\text{O}$, white; with hydroferricyanic acid, $3\text{H}_4\text{Fe}(\text{CN})_6 \cdot 4\text{Hmt} \cdot 16\text{H}_2\text{O}$, yellow; with hydrocobalticyanide, $3\text{H}_4\text{Co}(\text{CN})_6 \cdot 4\text{Hmt} \cdot 6\text{H}_2\text{O}$, white; with CdI_2 , $3\text{CdI}_2 \cdot 2\text{Hmt}$, white; with CdI_2 and HI , $2\text{CdI}_2 \cdot 2\text{HI} \cdot 3\text{Hmt}$, white; with HgI_2 and HI , $2\text{HgI}_2 \cdot 2\text{HI} \cdot 3\text{Hmt}$, lemon-yellow; with $\text{Cr}(\text{SCN})_3$ and HCNS , $2\text{Cr}(\text{SCN})_3 \cdot 3\text{HSCN} \cdot 5\text{Hmt}$, violet; with SnCl_2 and HCl , $\text{SnCl}_2 \cdot \text{HCl} \cdot \text{Hmt}$, white; with SnCl_4 and HCl , $2\text{SnCl}_4 \cdot \text{HCl} \cdot 3\text{Hmt} \cdot 4\text{H}_2\text{O}$, white; with tetrathiocyanatodiamminechromic acid, $4\text{H}[\text{Cr}(\text{SCN})_4(\text{NH}_3)_2] \cdot 3\text{Hmt}$, rose; with tetranitrodiamminecobaltic acid, $4\text{H}[\text{Co}(\text{NO}_2)_4(\text{NH}_3)_2] \cdot 3\text{Hmt}$, yellow. Conductivities of many of the above compds. confirm the structure assigned. G. L. CLARK

Preparation of cyanogen chloride. EMILIO SERNAGIOTTO. *Giorn. chim. ind. applicata* **3**, 153(1921).—The method of prepn. is based upon the reaction between Cl and HCN under the influence of light. A bulb tube about 70 cm. long contains in each bulb a plug of glass wool upon which animal charcoal is distributed. The glass wool renders the catalyzing mass more efficacious. The tube is surrounded with a glass sleeve which permits passage of water as condensing agent; and communicates on one side in series with a number of towers full of pieces of CaCO_3 moistened with H_2O , 2 towers filled with anhydrous CaCl_2 and a long worm immersed in broken ice. On the other side the tube communicates with a 3-way tube which conducts in equal volumes the 2 reacting gases. The Cl is drawn from a cylinder and passes first through a wash-bottle containing H_2SO_4 , the purpose of which is simply to permit the control of the amt. of gas passing through. The HCN issues from a flask as generator containing 1 part Na or Ca cyanide and $2\frac{1}{2}$ -3 parts NaHSO_4 , both in coarse powder and intimately mixed. The generator is connected by sep. tubes to a reflux condenser, a Hg safety valve and a glass tube drawn out to a point at the end and communicating by means of a rubber tubing with a Mariotte bottle filled with H_2O and placed 2 m. above the generator. The HCN is formed by allowing the H_2O to drop from the Mariotte bottle upon the mixt. in the generator. The HCN passes out of the generator through the reflux condenser, which serves for the first elimination of the H_2O which the gas carries, then through 1 or 2 CaCl_2 towers, then through a wash-bottle containing anhydrous glycerol (to control the amt. of gas passing to the catalyzer) and finally to the catalyzer. At first the reaction in the flask develops enough heat to distil the HCN , but towards the end the flask must be heated. The union of the HCN and Cl in the catalyzer develops a great deal of heat. The HCl produced must be eliminated in order to prevent polymerization of the CNCl . This elimination is carried out by the moistened CaCO_3 . The CO_2 formed carries along with it the CNCl , which condenses in the ice-cooled worm and is collected in an appropriate vessel. The gas escaping condensation is allowed to go up a ventilating hood, or better is burned in the air as it leaves the app. from a tubulation. If the operation is carefully regulated, neither Cl nor HCN passes out of the app.

ROBERT L. POSMONTIER

Preparation and some physical constants of cyanogen chloride. CH. MAUGIN AND L.-J. SIMON. *Ann. chim.* **15**, 18-41(1921).—See C. A. **14**, 29. M. R. SCHMIDT

Action of hydrochloric acid on the tetroxides of osmium and ruthenium. HEINRICH REMY. *J. prakt. Chem.* (ii), **101**, 341-52(1920).—The contradiction between the observation of Milbauer (*C. A.* **12**, 2172) that OsO_4 is decomposed by concd. HCl at the ordinary temp., and that of Ruff and Mugdan (*C. A.* **13**, 1433) that no action occurs, is due to differences in the strengths of acid employed. Acid with $d. > 1.160$ reacts at the ordinary temp. giving OsCl_4 (cf. Milbauer, *loc. cit.*); RuO_4 reacts still more easily (cf. Ruff and Mugdan, *loc. cit.*), forming the trichloride. J. C. S.

The relative firmness of the combination of sulfurous acid with ammonia and mercury. OTTO RUFF AND ERICH KRÖHNERT (WITH HANS JULIUS BRAUN). *Z. anorg. allgem. Chem.* **114**, 203-8(1920).—The ppt. obtained from HgCl_2 and excess of NH_3 dissolves when SO_2 is passed through the liquid, and cryst. compds. of HgO with NH_3 and SO_2 are obtained on evapn. under reduced pressure. If SO_2 is first added and then NH_3 an insol. compd. contg. SO_2 and NH_3 is slowly deposited. The reactions were found to be: (a) $\text{HgCl}_2 + 2\text{H}_2\text{SO}_3 + 4\text{NH}_3 = \text{Hg}^+(\text{SO}_3\text{NH}_4)_2 + 2\text{NH}_4\text{Cl}$, (b) $\text{NH}_3\text{Hg}^+\text{Cl} + \text{H}_2\text{SO}_3 = \text{Hg}^+\text{Cl}(\text{SO}_3\text{NH}_4)$, in acid solutions. With excess of NH_3 , a mixt. of $\text{Hg}^+(\text{SO}_3\text{NH}_4)_2$, a white, insol. powder, and $\text{Hg}^+\text{SO}_3\text{NH}_3$ or $\text{Hg} \begin{smallmatrix} \text{SO}_2 \\ \diagup \quad \diagdown \\ \text{NH}_3 \end{smallmatrix}$, white needles,

is pptd. $\text{Hg}^+(\text{SO}_3\text{NH}_4)_2 + \text{NH}_3 = \text{Hg}^+\text{SO}_3\text{NH}_3 + (\text{NH}_4)_2\text{SO}_3$. In presence of large amts. of NH_4Cl , one of the sulfonic groups is eliminated: $\text{Hg}^+(\text{SO}_3\text{NH}_4)_2 + \text{NH}_4\text{Cl} + \text{NH}_3 = \text{NH}_3\text{Cl.Hg.SO}_3\text{NH}_4 + (\text{NH}_4)_2\text{SO}_3$. The compd., $\text{NH}_3\text{Cl.Hg.SO}_3\text{NH}_4$, forms long, white, transparent needles. 2N KOH converted this into yellow $\text{Hg}_2\text{O.SO}_3\text{NH}_3$,

or $\text{Hg} \begin{smallmatrix} \text{Hg} \cdots \text{SO}_2 \\ \diagup \quad \diagdown \\ \text{Hg.NH}_3 \end{smallmatrix}$. Concd. NH_4OH forms a soln. which appears to contain

$\text{Hg}(\text{NH}_3)_4\text{SO}_3$; liquid NH_3 forms $\text{Hg}(\text{NH}_3)_6\text{SO}_3$, as a white powder, and $(\text{NH}_4)_2\text{SO}_3$. In acid soln. the S, which receives a negative charge from O, and in alk. the N, which receives a negative charge from H, possess a strong tendency to complex formation, and in ammoniacal soln., complexes corresponding to mercurammonium sulfites are formed. J. C. S.

Investigations on the salt character of lithium hydride. KURT MOHR. *Z. anorg. allgem. Chem.* **113**, 179-228(1920).—Exptl. details are given for the prepn. of LiH from Li and H . To decide whether LiH has the characteristics of a salt or no, the action of Hg on LiH has been studied, and it is shown that the action is a decompn., and not a soln., which points to the fact that LiH is a salt. Investigation of the appearance, crystal form, density, heat changes, and sp. heat and the detn. of the various consts., and comparison of these with the corresponding consts. for the alkali halides all point to the salt character of the hydride. The following consts. have been detd.: $d.$ 0.816; mol. vol. 9.77; heat of formation 21,600 \pm 250 cal.; $\text{Li} + \text{H}_2\text{O} = \text{LiOH} + \frac{1}{2}\text{H}_2 + 52723 \pm 200$ cal.; $\text{LiH} + \text{H}_2\text{O} = \text{LiOH} + \text{H}_2 + 31110 \pm 50$ cal. The elec. cond. has been detd. with both direct and a. c. The d. c. expts. show a very large increase in cond. with increase in temp., but on account of polarization which occasioned subsidiary changes a temp.-cond. curve could not be constructed. With a. c. it is shown that the cond. increases with increasing temp. until it reaches values of the same order as that of H_2SO_4 of max. cond. The temp.-coeff. of the cond. shows a max. at 550°. Galvanic polarization could be detected, and its changes followed and measured. With d. c. the products of the electrolysis could be isolated. The presence of H was proved by the increase in pressure during electrolysis in a vacuum, and metallic Li was found on the cathode. From these facts and others it is practically certain that in the electrolysis of LiH , H is liberated at the anode, and this represents the first instance in which H appears as a negatively charged ion. It is therefore shown that LiH is to be regarded

as a salt in which Li constitutes the cation and H the anion, and H is to be regarded as an extremely weak acid. J. C. S.

The existence of a gaseous hydride of thorium. ALBERT KLAUBER AND JULIUS MELL VON MELLENNHIM. *Z. anorg. allgem. Chem.* 113, 306–16 (1920).—An alloy of Th and Mg was prepd. by heating Th oxide, ThO_2 , with 2–2½ times its wt. of Mg powder for 45 min. to a dull red heat in a stream of H. A blackish brown to grey product was obtained, which, when powdered in a mortar, gave a characteristic odor of ThH_4 . The gas was formed when the alloy was treated with water or dil. acids, and had a tendency to ignite spontaneously. To identify the gas, the method used by Paneth (C. A. 15, 213) for identifying Pb and B hydrides was used, the gas being passed through a heated Marsh tube, when a deposit of Th was obtained, which was identified by a number of characteristic reactions. The Th is at first deposited in the form of a brown ring, which, on further heating, becomes dark grey with a metallic appearance, indicating the existence of two modifications of Th. The hydride is very unstable, and is produced in greatest amt. at a temp. of 15–20°. The compn. of the hydride could not be detd. The gas can be condensed with liquid air. Its radioactivity is very slight. J. C. S.

Oxidizing action of ceric sulfate. A. BENRATH AND K. RULAND. *Zeitsch. anorg. allgem. Chem.* 114, 267–277 (1920).—In the oxidation of tartaric acid by $\text{Ce}(\text{SO}_4)_2$ in presence of H_2SO_4 , small quantities of didymium sulfate are without influence on the velocity. Formic acid is produced, $\text{C}_4\text{H}_6\text{O}_6 + 8\text{Ce}(\text{SO}_4)_2 + 2\text{H}_2\text{O} = 3\text{CO}_2 + \text{HCO}_2\text{H} + 4\text{Ce}_2(\text{SO}_4)_3 + 4\text{H}_2\text{SO}_4$. Addition of H_2SO_4 strongly retards the reaction. Oxalic acid is oxidized to CO_2 , $\text{C}_2\text{H}_2\text{O}_4 + \text{Ce}(\text{SO}_4)_2 = 2\text{CO}_2 + \text{Ce}_2(\text{SO}_4)_3 + \text{H}_2\text{SO}_4$. H_2SO_4 and normal sulfates retard this reaction. Complex formation was not observed. The oxidation of anthracene is strongly accelerated by addition of H_2SO_4 . The oxidation of hydrazine occurs according to the equation $2\text{N}_2\text{H}_4 + 2\text{Ce}(\text{SO}_4)_2 = \text{N}_2 + (\text{NH}_4)_2\text{SO}_4 + \text{Ce}_2(\text{SO}_4)_3$. NH_4OH gave nitrogen and N_2O (69–73%). $\text{Na}_2\text{S}_2\text{O}_3$ was converted into tetrathionate, $2\text{Na}_2\text{S}_2\text{O}_3 + 2\text{Ce}(\text{SO}_4)_2 = \text{Ce}_2(\text{SO}_4)_3 + \text{Na}_2\text{SO}_4 + \text{Na}_2\text{S}_4\text{O}_6$. H_2SO_4 forms equiv. amts. of H_2SO_4 and $\text{H}_2\text{S}_2\text{O}_6$; H_3PO_4 is oxidized to H_3PO_5 . Photooxidation of formic acid, MeOH , and AcOH is retarded by H_2SO_4 . J. C. S.

Preparation of uranium compounds in the pure state. ERNST WILKE-DÖRFURT. *Wiss. Veröffentl. Siemens-Konzern* 1, 143–6 (1920).—In connection with an investigation of the catalytic activity of U compds., an attempt was made to obtain a highly purified U oxide, U_3O_8 , from some residues of cleveite which had been used for the extn. of He. A soln. of the nitrate which had been purified from the rare earth metals and Th by oxalic acid, and from extraneous heavy metals by H and NH_4 sulfides, yielded an oxide, which was not free from alkali. In the opinion of W., the presence of the later is due to co-pptn. of uranate, and not to adsorption, and can therefore be avoided by reduction of the U. By suitable regulation of the action of $(\text{NH}_4)_2\text{S}$, it is found possible to ppt. uranous instead of uranyl sulfide, and this substance does not show any tendency to retain alkali; the latter, if absorbed, can be removed by double pptn., and avoided by working with smaller quantities. The sulfide is readily converted into uranous chloride, which is transformed through the hydroxide into the nitrate; the latter is oxidized by HNO_3 to uranyl nitrate, which is purified by being crystd. from water, and then converted into the oxide, U_3O_8 , in which the presence of traces of alkali cannot be detected spectroscopically. W. avoids the frequently recommended crystn. of uranyl nitrate from ether, since, on the one hand, the product so obtained is not free from alkali, and, on the other the explosive tendency of the ethereal soln. renders it unsuitable for working with very valuable material. J. C. S.

The reaction of sodium salts with uranyl acetate alone and in the presence of salts of magnesium, zinc, cadmium, and beryllium. STANKO S. MIHOVIĆ. *Bul. Acad. Sci. Zagreb.* 1920, 16–23.—Na uranyl diacetate has a soly. of 4.62 g. in 100 g. of soln. at

20°. Na uranyl magnesium triacetate crystallizes with 6 H₂O and Na uranyl zinc triacetate with 4½ H₂O. None of these salts can be used for the estn. of Na owing to the soly. of the diacetate and the tendency of the triacetate to vary in compn. according to the conditions under which it seps. M. was not able to obtain triacetates contg. Cd or Be. J. C. S.

Properties of potassium arsenothiosulfate: Structural formula of trithionic acid.

JULIUS VON SZILÁGYI. *Z. anorg. allgem. Chem.* 113, 75-84(1920).—K arsenothiosulfate is prepd. by adding a soln. of 37.24 g. of crystd. Na₂S₂O₃ in 60 cc. of water to a soln. of 4.95 g. of As₂O₃ in 35 cc. of HCl. (d. 1.06) and 11.18 g. of KCl in 30 cc. of water at 3°. Three vols. of 96% alc. are added to the mixt. when the double salt is pptd. It is rapidly filtered and washed with alc. and ether. It is a pure white compd., which is not very stable in the moist condition; it is amorphous, and is very sol. in water, slightly sol. in 50% alc., and insol. in abs. alc., ether, and CHCl₃, d₄²⁰ 2.292. When quite dry, it may be preserved, but when moist, even with CHCl₃ or ether, it becomes yellow. When the dry salt is heated, it decomposes according to the equation $2K_2As(S_2O_3)_3 = As_2S_3 + 3K_2SO_4 + 3SO_2 + 3S$; on keeping or boiling a soln. of the salt it decomposes according to the equation $2K_2As(S_2O_3)_3 = As_2S_3 + 3K_2S_2O_8$. Attempts to prep. corresponding Na and Rb salts failed. The general relationships of the complex As, Bi, and Sb thiosulfates are considered (see Hauser, *Z. anorg. Chem.* 35, 1-10(1903)), and it is shown that the existence and properties are influenced by the character of the trivalent element. In any given series of compds. the soly. increases in the order K, Rb, Cs, Ba, Na. S. deduces the structural formula of trithionic acid from the decompn. of K arseno-thiosulfate, which can only take place thus: $(K_2O \cdot SO_3)_3 \cdot As_2(S_2O_3)_3 \cdot (S_2O_3 \cdot OK)_3 = As_2S_3 + 3KO \cdot SO_3 \cdot S_2SO_3 \cdot OK$, which gives trithionic acid the persulfide formula. J. C. S.

Chemistry of the platinum metals. I. Existence of bivalent ruthenium compounds.

HEINRICH REMY. *Z. anorg. allgem. Chem.* 113, 229-52(1920).—After a general discussion of the valency of the Pt metals, it is shown that only one compd., ruthenocyanic acid, is known in which the Ru exists in the bivalent condition. R. has examd. the blue solns. of Ru compds. obtained by the action of reducing agents on ruthenic compds. and other derivs. of a higher state of oxidation. The method consisted in titrating solns. of ruthenic chloride with dil. Na amalgam until the sepia-brown color of the soln. changed to clear blue. Further additions of amalgam did not affect the color, but there was a pptn. of metallic Ru. All expts. were carried out in an atm. of CO₂. The expts. show that in the blue soln. Ru is present for the most part in the bivalent condition, but it appears to be impossible to effect a complete conversion of all the Ru into the bivalent condition without at the same time reducing some of it to the metallic condition. There are indications that a proportion of the bivalent Ru ions is converted into univalent Ru ions. The action of a number of reagents on the blue solution has been investigated: Cold NaOH gives a brown coloration which, if the solns. are concd., becomes a brown ppt., sol. in HCl to form a blue soln., but if only a trace of air is admitted the soln. is green; hot NaOH gives a dark brown ppt. which is sol. in 10% HCl with the formation of a yellowish brown soln.; NH₃ gives a greyish black ppt. sol. in HCl to a blue soln. and sol. in excess of NH₄OH to a dark violet soln.; hot (NH₄)₂CO₃ gives a dark green coloration; I solns. are decolorized in the presence of acid. The whole of the reactions of bivalent Ru solns. show that in this valency stage Ru compds. are excessively unstable. J. C. S.

Antimony pentasulfide (sulfur aurum). F. KIRCHHOFF. *Z. anorg. allgem. Chem.* 114, 266(1920); cf. *C. A.* 15, 1469. —Some varieties of com. sulfur aurum contain less than 8% (0-2%) of S readily extd. by solvents. These are probably obtained by the reaction $Na_3SbS_4 + SbCl_3 = Sb_2S_4 + 3NaCl$. J. C. S.

Some alkali antimony thiosulfates. JULIUS VON SZILAGYI. *Z. anorg. allgem. Chem.* 113, 69–74 (1920).—The prepn. and properties of stibio-thiosulfates of Na, K, Rb, Ba, Ca, and Sr are described. The method of prepn. consists in adding a soln. of Sb_2O_3 in HCl (d. 1.12) to a soln. of $\text{Na}_2\text{S}_2\text{O}_3$ and the chloride of the metal concerned at low temps., about 3° . The formation is represented by the equations: $\text{SbCl}_3 + \text{H}_2\text{O} = \text{SbOCl} + 2\text{HCl}$; $\text{SbOCl} + 2\text{HCl} + 3\text{Na}_2\text{S}_2\text{O}_3 = 3\text{NaCl} + \text{H}_2\text{O} + \text{Na}_3\text{Sb}(\text{S}_2\text{O}_3)_3$. The salts in all cases, except those of Na, Ca, and Sr, may be crystd. at low temps. and are pptd. by the addition of 96% alc. *Sodium stibio-thiosulfate*, $\text{Na}_3\text{Sb}(\text{S}_2\text{O}_3)_3$, is extremely sol., and has not been obtained in the solid condition; all attempts to obtain the solid salt brought about decompn. according to the equation $2\text{Na}_3\text{Sb}(\text{S}_2\text{O}_3)_3 = 3\text{Na}_2\text{S}_2\text{O}_3 + \text{Sb}_2\text{OS}_3 + 4\text{SO}_2$. *Potassium stibio-thiosulfate*, $\text{K}_3\text{Sb}(\text{S}_2\text{O}_3)_3$, forms silk-like, needle-shaped crystals very similar in appearance to asbestos. It is very sol. in water, and on diluting the soln. a very slight turbidity is produced which points to the presence of the complex ion, $\text{Sb}(\text{S}_2\text{O}_3)_3^{'''}$. On boiling a soln. decompn. occurs, forming the orange-red compd., Sb_2OS_3 , as in the case of the Na compd. On heating the crystals above 100° the decompn. $2\text{K}_3\text{Sb}(\text{S}_2\text{O}_3)_3 = \text{Sb}_2\text{S}_3 + 3\text{K}_2\text{SO}_4 + 3\text{SO}_2 + 3\text{S}$ takes place. This compd. is shown to have the constitution $\text{Sb}(\text{S}_2\text{O}_3)_3$. The Rb salt is similar in all respects to the K salt. *Barium stibio-thiosulfate*, $\text{Ba}_3[\text{Sb}(\text{S}_2\text{O}_3)_3]_2$, is not very stable at the moment of pptn.; it is white, but speedily becomes yellow, and finally very deep yellow in color, due to decompn. The Sr and Ca salts exist for only a very short time in soln., and have not been isolated. J. C. S.

Transformation of light magnesia into the dense form. N. PARRAVANO AND C. MAZZETTI. *Atti accad. Lincei* 30, i, 63–6 (1921).—The results of the authors' expts. show that the velocity of hydration of MgO diminishes as the temp. and duration of its previous calcination are increased, no discontinuity being observable. The statement that MgO undergoes transformation at about 1600° (Le Chatelier, *Le Chauffage* 399) or 1100° (Campbell, *C. A.* 12, 268) is inaccurate, this change having already begun at the lowest temp. employed by the authors, namely 800° , at which, however, it proceeds very slowly. This result is confirmed by Ditte's measurements of the density of the oxide after being heated at definite temps. for a certain time (*J. Chem. Soc.* 24, 869 (1871)). Natural magnesites contain impurities which exert a marked influence on the velocity of hydration of the oxide resulting from their calcination, the transformation into the dense modification being facilitated. This change is at first slow and continually increases in rapidity as the temp. is raised, and no definite transformation temp. probably exists. J. C. S.

Apparatus for simultaneous pressure and volume measurements of gases. GUSTAV F. HÜTTIG. *Z. anorg. allgem. Chem.* 114, 161–73 (1920).—An app. is described in which the pressure and vol. of a gas liberated in any reaction may be detd. at any moment. Gas may be added to or withdrawn from the system at any time, and the compn. of the residue detd. The app. consists essentially of a detachable tube for the solid, connected through a detachable stopcock with a bulb communicating with a manometer. The vol. of each part of the app. is known. The whole app. is exhausted, and gas admitted to the bulb and upper part of the stopcock. The manometer is read, and the initial vol. of gas calcd. The stopcock is then opened, and from the manometer readings the pressure and vol. of the gas are readily calcd. By means of the app., the existence of $\text{FeCl}_3 \cdot 12\text{NH}_3$ (9 mm. at -70°); of $\text{AgBr} \cdot 3\text{NH}_3$, and of $\text{Ca} \cdot 6\text{NH}_3$ could be demonstrated. In the last case, a secondary reaction, $\text{Ca} \cdot 6\text{NH}_3 = \text{Ca}(\text{NH}_2)_2 + 4\text{NH}_3 + \text{H}_2$ occurs, as well as a slow absorption of H in the solid phase. J. C. S.

Halogen silver ammoniates. WILHELM BILTZ AND WILHELM SPÖLLENWERK. *Z. anorg. allgem. Chem.* 114, 174–202 (1920); cf. *C. A.* 14, 2441.—XI. The apps. of Hüttig (see preceding abst.) was used. Freshly pptd. Ag halides are necessary, since

these lose their activity on keeping. The existence of $\text{AgCl} \cdot 3\text{NH}_3$ and $2\text{AgCl} \cdot 3\text{NH}_3$ was confirmed, and a new compd., $\text{AgCl} \cdot \text{NH}_3$, with dissoc. pressures previously given for $2\text{AgCl} \cdot 3\text{NH}_3$ was obtained. The sesqui- and mono-ammoniates form mixed crystals above 30° . The existence of the compds. $\text{AgBr} \cdot 3\text{NH}_3$, $2\text{AgBr} \cdot 3\text{NH}_3$, and $\text{AgBr} \cdot \text{NH}_3$ was confirmed as well as that of the compds. $\text{AgI} \cdot 3\text{NH}_3$, $2\text{AgI} \cdot 3\text{NH}_3$, $\text{AgI} \cdot \text{NH}_3$, and $2\text{AgI} \cdot \text{NH}_3$. All the iodides form mixed crystals. The heats of formation were calcd. from Nernst's formula $\log p = -Q_0/4.57T + 1.75 \log T + aT + 3.3$ as follows (values of Q_0): $\text{AgCl} \cdot 3\text{NH}_3$, 9.16 Cal.; $\text{AgCl} \cdot 1\frac{1}{2}\text{NH}_3$, 10.52 Cal.; $\text{AgCl} \cdot \text{NH}_3$, 11.11 Cal.; $\text{AgBr} \cdot 3\text{NH}_3$, 8.64 Cal.; $\text{AgBr} \cdot 1\frac{1}{2}\text{NH}_3$, 9.95 Cal.; $\text{AgBr} \cdot \text{NH}_3$, 10.65 Cal.; $\text{AgI} \cdot 3\text{NH}_3$, 6.92 Cal.; $\text{AgI} \cdot 1\frac{1}{2}\text{NH}_3$, 7.25 Cal.; $\text{AgI} \cdot \text{NH}_3$, 8.56 Cal.; $\text{AgI} \cdot 2\text{NH}_3$, 7.05 Cal.; $\text{AgI} \cdot \frac{1}{2}\text{NH}_3$, 11.59 Cal. The values of the const. a in the equation were found to be:

	3NH_3	2NH_3	$1\frac{1}{2}\text{NH}_3$	NH_3	$\frac{1}{2}\text{NH}_3$
$\text{AgCl} \dots\dots$	-0.0025	.....	-0.0015	-0.0015	.....
$\text{AgBr} \dots\dots$	-0.0028	.....	-0.0020	-0.0015	.....
$\text{AgI} \dots\dots$	-0.0050	-0.0050	-0.0050	-0.0030	-0.0010

Conclusions on the affinities are drawn from the temps. at which the dissoc. pressures reach 100 mm. in all cases; these are in the order AgI , AgBr , AgCl . J. C. S.

Compounds of ammonia with metallic calcium, strontium, and barium. WILHELM BILTZ AND GUSTAV F. HÜTTIG. *Z. anorg. allgem. Chem.* 114, 241-65 (1920).—A description of the method of prepn. of Sr and Ba by the method of Guntz (*Compt. rend.* 143, 339-40 (1906)) is given. All the alk. earth metals form hexammines, $\text{M}(\text{NH}_3)_6$. The values of Q_0 (see preceding abstr.) were found from the tension curves to be: $\text{Ca}(\text{NH}_3)_6$, 10.32 Cal.; $\text{Sr}(\text{NH}_3)_6$, 9.91 Cal.; $\text{Ba}(\text{NH}_3)_6$, 9.65 Cal. The reaction $\text{M}(\text{NH}_3)_6 = \text{M}(\text{NH}_3)_4 + 2\text{NH}_3$ occurs rapidly with Ba, slowly with Ca. The identical behavior of the metal atom and ion is pointed out. This may indicate that the presence of the two valency electrons in the atom has no influence on the absorption, or that the metal is composed of ions and free electrons. J. C. S.

7—ANALYTICAL CHEMISTRY

WILLIAM T. HALL

Guides to analyses. VIII. The interpretation of paint analysis. EDWARD C. HOLTON. *Chem. Bull.* (Chicago) 8, 128-9 (1921).—Some of the difficulties involved in the interpretation of the results obtained by proximate analysis are outlined and general advice is given. W. T. H.

The application of spot reactions in qualitative analysis. FRIEDRICH FEIGL AND ROSA STERN. *Univ. Vienna. Z. anal. Chem.* 60, 1-43 (1921).—Many useful qualitative tests can be made by means of test papers which have been treated with suitable reagents. Thus litmus paper serves for the detection of acids and bases and $(\text{AcO})_2\text{Pb}$ paper for the detection of sulfide. When a drop of soln. is placed upon filter paper, the rate at which the liquid is absorbed by the paper depends not only upon the quality of the paper but also upon the nature and concn. of the soln. tested. Upon a single strip of paper, therefore, two or more substances may be detected, the substances which diffuse most rapidly being formed farthest away from the portion of paper originally wetted. In this investigation, a series of tests was studied by means of which it is possible to test for all the members of the ammonia and ammonium sulfide group of cations (Fe^{+++} , Cr^{+++} , Al^{+++} , Ni^{++} , Co^{++} , Mn^{++} , Zn^{++} and UO_2^{++}) without any filtration except when Co and Zn are both present. The tests for the most part are very sensitive. (1) *Aluminium*.—Prepare alizarin test paper by moistening filter paper with a satd

alc. soln. of alizarin and drying a short time. The paper is yellow or yellowish pink. Place a drop of the soln. to be tested upon the test paper and hold over an open ammonia bottle. The alizarin itself is turned violet except at the test spot, which is pink or violet if Al is present. Dry in the hot closet for about 1 min.; the unchanged alizarin assumes its original color and the presence of Al is shown by a beautiful pink spot. The test is obtained with a single drop of a soln. contg. only 0.3 mg. per liter. If Fe is present, the test is obscured because a violet ferric lake is obtained with alizarin. In this case moisten a filter paper with satd. $K_4Fe(CN)_6$ soln. and dry. Place a drop of the soln. to be tested upon the dried paper; a Prussian blue spot is obtained which is usually surrounded by a paler border. If this pale zone is not obtained at first, it may be produced by adding a drop of water to the center of the blue spot. Add a drop of alc. alizarin soln. and dry; the characteristic Al color will be obtained if 0.004 mg. of Al was present even with 200 times as much Fe. If considerable Cr is present, the Al spot is more or less yellow and it is advisable to make a blank test with pure chromic alum soln. Mn forms a violet lake which also obscures the test for Al. The Mn, however, may be fixed as $Mn_2Fe(CN)_6$ by testing as in the presence of Fe. The test for Al fails when 800 times as much Mn is present. A similar procedure is used when Zn is present. With U, $(UO_2)_2Fe(CN)_6$ is formed but this ppt. is slimy and tends to diffuse with the Al soln. In such cases the uranyl ppt. may be dissolved off the paper by $(NH_4)_2CO_3$ soln. or the ppt. may be fixed by adding a drop of concd. $FeCl_3$ soln. The sepn. of Al and U may be effected by capillarity; a blue UO_2 spot is obtained in the center surrounded by the characteristic pink of Al-alizarin lake. Co gives a violet color with alizarin and with NH_3 bluish green Co compds. are obtained which may also mask the Al test. In such cases treat the spot, which has been developed upon the alizarin paper by treatment with NH_3 and drying, with 0.01 N HCl to dissolve off the Co compd.

(2). *Manganese*.—A very sensitive test for Mn depends upon the fact that benzidine is oxidized by MnO_2 with the formation of a deep blue substance. In a test-tube the color is transitory but upon test paper it is more stable. It is nearly as sensitive as the permanganate formation by means of PbO_2 in HNO_3 soln. and has the advantage that chlorides do not interfere. Place a drop of the soln. to be tested upon filter paper, add a drop of KOH soln. and then a drop of saturated benzidine in acetic acid. The deep blue test disappears on drying but reappears when fresh benzidine soln. is added. The behavior of Fe in this test is interesting. If a ferric salt is treated with benzidine soln., a deep blue or nearly black spot is obtained but if the spot is first treated with alkali before adding the benzidine, no color is obtained with the Fe. There is, therefore, no interference provided the Fe is completely pptd. as hydroxide. If considerable Fe is present it is advisable, however, to add a little tartrate to the caustic alkali soln. used in the test. Co tends to give the same reaction as Mn with benzidine but the test is not so sensitive because the formation of $Co(OH)_2$ by atmospheric oxidation takes place more slowly than that of MnO_2 from $Mn(OH)_2$. By adding tartrate to the caustic alkali soln. the reaction between benzidine and Co is prevented and the Mn test can be obtained.

(3) *Chromium*.—Spot tests which depend upon the formation of $PbCrO_4$ or of Ag_2CrO_4 are fairly sensitive. The oxidation of the Cr^{+++} to CrO_4^{--} can be effected by placing a drop of the soln. on filter paper, adding a drop of KOH soln. and holding the paper in fumes of Br_2 . A yellow spot can then be obtained with Pb acetate or a red spot with Ag^+ . It is also possible to detect Cr^{+++} ions by the formation of lakes with certain dyestuffs. Six alizarin dyes were tried and the best results obtained with *acid alizarin yellow RC* and *acid alizarin red G*. Paper impregnated with the former is obtained by treatment with a boiling hot ammoniacal soln. of the dye but with the latter the dyebath must be acid. With *acid alizarin yellow*, place a drop of the soln. to be tested on the dry test paper, dry and dip for a few sec. in hot 0.5 N H_2SO_4 ; this serves to destroy the

effects produced by other elements in this qualitative group of metals. Rinse off the acid with water and then place the paper in ammonia water. If Cr is present, an orange-yellow spot remains on the paper but if this element is absent the dyestuff is turned orange and dissolves in the NH_4OH soln. With acid alizarin red, Cr causes a spot to form which, in contrast to the spots caused by other elements, is unaffected by hot, dil. H_2SO_4 . (4) *Zinc*.—This element can be detected by the formation of $\text{ZnHg}(\text{CNS})_2$ even in very dil. soln. To prepare the $\text{KHg}(\text{CNS})_2$ reagent, add solid $\text{Hg}(\text{NO}_3)_2$ or $\text{Hg}(\text{CNS})_2$ to 20% KCNS soln. until no more of the salt will dissolve, and filter. As the Zn ppt. is white, it is necessary to use black test paper, or, still better, to carry out the test on a microscope slide. Take a drop of the soln. to be tested and mix it with a drop of the reagent and rub to cause pptn. from the supersatd. soln. which is likely to form. Co gives a characteristic blue ppt. with the reagent so that in the presence of this element it is necessary to ppt. the Co by treatment with KOH and filter off the insoluble hydroxide. The zincate soln. is made acid and tested with $\text{K}_4\text{Fe}(\text{CN})_6$; the complex mercury salt cannot be used as the Zn ppt. is sol. in the presence of alkali salt. (5) *Cobalt*.—Six sensitive Co tests were studied and the most sensitive found to be the Ilinsky test with α -nitroso- β -naphthol. Place a drop of the soln. to be tested upon filter paper and add a drop of a 50% soln. of the reagent in AcOH . Fe interferes with the test but can be rendered harmless by first adding $(\text{NH}_4)_2\text{HPO}_4$ to form FePO_4 . If U is present a similar treatment with phosphate prevents interference. (6) *Uranium*.—This element can be detected with $\text{K}_4\text{Fe}(\text{CN})_6$ paper (brown spot), with alizarin paper (blue spot) or by means of α -nitroso- β -naphthol (yellow spot). In the presence of Fe, the spot produced with $\text{K}_4\text{Fe}(\text{CN})_6$ should be moistened with water; the U ppt. is then to be detected at the outer border. If considerable Fe is present it is best to proceed as follows: Place a drop of strong NH_3 soln. upon a filter paper and, before the first drop is entirely absorbed, add a drop of the soln. to be tested and stir with a glass rod. Dry, moisten with a drop of $(\text{NH}_4)_2\text{CO}_3$ soln. and, with the aid of a stirring rod, make certain that every bit of the spot is wetted by the carbonate soln. Dry and then carefully add a drop of dil. HCl and one of $\text{K}_4\text{Fe}(\text{CN})_6$ soln. just outside the border of the spot. (7) *Iron*.—The well known Prussian blue test is used. (8) *Nickel*.—The test with dimethylglyoxime is much more sensitive on filter paper than in a test-tube.

W. T. H.

Qualitative analysis by spot reactions according to F. Feigl and R. Stern. F. HAUSER. Univ. Vienna. *Z. anal. Chem.* 60, 88-91(1921).—The tests proposed by Feigl and Stern (see preceding abstract) were tested in 220 cases and found to give excellent results. Not only are the tests useful for the analysis of the Fe-Al group of cations by itself but they may be applied in the presence of most other ions and anions. A slightly acid soln. is advisable in all cases.

W. T. H.

Industrial chlorobenzene. F. BOURION. *Ann. chim.* 14, 215-72, 273-321(1920); cf. C. A. 14, 2166, 2624, 3207.—The work previously reported on the analytical distn. of com. PhCl is again described. A second method, called the "method of enrichment," depends on sepg. the sample into 3 fractions, the first b. 80° , the second 80 - 130° plus a portion of the material distg. at 130° , and the third consisting of the residue. The sample, fractions, and residue are weighed, and their $d_{15.5}$ is taken accurately. By using a const. factor, C , representing the change in d . of C_6H_5 produced by 1% of PhCl , or the change in d . of PhCl produced by 1% of "polychlorides" ($\text{C}_6\text{H}_4\text{Cl}_2$, etc.), the % of these compds. in each fraction is calcd., and hence the compn. of the original sample. Various refinements of this method are discussed, including a method for calcg. the coeff. C (which varies slightly) from the d . of the fractions. On the assumption that the chlorination reaction is of the first order with reference to C_6H_6 or PhCl , K_n is found to be 0.118.

M. R. SCHMIDT

Titration with potassium permanganate. ANT. JULEK. *Chem. Listy* 15, 105 9.

138-40(1921).—The titration of the standard substances like $\text{Na}_2\text{C}_2\text{O}_4$, $\text{H}_2\text{C}_2\text{O}_4$, Mohr's salt and electrolytic Fe (prepd. either according to Treadwell or Classen) was studied. The results of these titrations agreed with each other more closely, if the amts. of 0.1 *N* KMnO_4 used, expressed in cc., were approx. the same; *i. e.*, such amts. of the salts in question should be used so as to require about 36 cc. of the 0.1 *N* KMnO_4 for their titration. Treadwell's method did not require a blank detn. Standardization against $\text{Na}_2\text{C}_2\text{O}_4$, $\text{H}_2\text{C}_2\text{O}_4$, and Mohr's salt proved to be very facile and accurate. Classen's method was rapid and accurate, if the Fe dissolved in H_2SO_4 was washed into a flask and then titrated in the presence of Pt. Investigation of the possible oxidation of FeSO_4 disclosed the fact that solns. of 0.1 *N* FeSO_4 , weakly acidified with H_2SO_4 , and exposed to air, were found to be practically unaffected after 24-48 hrs. There is practically no danger of the oxidation of these solns. during their filtration through paper or glass wool.

JOHN M. KRNO

The estimation of phosphoric acid by the molybdate method. J. E. CLENNELL. *Mining Mag.* 23, 213-6(1920).—The well known molybdate methods for the detn. of H_3PO_4 are discussed in detail.

A. BUTTS

Estimation of the pentose sugars. HERMAN AUGUSTUS SPOHR. *Carnegie Inst. Pub.* No. 287, 36-7(1919).—The hexose sugars are fermented with baker's yeast; the alc. and other products of fermentation are removed by distn. The residual soln. contg. pentoses is then caused to react with hot Fehling soln.; and the Cu_2O obtained by reduction is detd. by an iodometric titration. The non-fermentable sugar must be recognized as pentose by the proper tests.

JOSEPH S. HEPBURN

The detection of arsenic. L. W. WINKLER. *Pharm. Zentralhalle* 62, 125-8(1921).—Small amts. of As can be detected by the Bettendorf test; by a test in which As is converted to AsH_3 and detected by means of Nessler's reagent; or by a modification of the Gutzeit test in which AsH_3 is detected by the color it gives paper moistened with AuCl soln. The Bettendorf test can be applied in the presence of H_2SO_4 and can be used in the case of dark-colored substances. In this case it is necessary to treat the soln. first with Zn and H_2SO_4 and then test a soln. of the evolved gas for As. Sb, S, and P compds. interfere with the Nessler test.

H. A. SHONLE

A new method for the volumetric determination of nickel. GINO ZUCCARI. *Boll. chim. farm.* 59, 25-7(1920).—Na nitroprusside ppts. quant. Ni from its salts in acid soln. A sepn. from Fe^{+++} , Al, Zn, Sn, Pb, Mn, etc., can thus be effected. For quant. detn. a 0.5 *N* soln. of $\text{Na}_2\text{Fe}(\text{CN})_5\text{NO} + 2\text{H}_2\text{O}$ is used, or an empirical soln. containing 50.771 g. per l. of which 1 cc. = 0.01 g. metallic Ni. This soln. is added dropwise from a buret to the Ni soln. with continual stirring. When the ppt. has assumed a clear ash color and the supernatant liquid is colorless, a drop is filtered and tested with Na_2S . Absence of a black color indicates complete pptn. A slight excess of the reagent is indicated by a pale violet color of the soln. To obtain best results the Ni soln. should not be more dil. than 1 1/2% and should be distinctly acid. Co is likewise pptd. by $\text{Na}_2\text{Fe}(\text{CN})_5\text{NO}$, but this ppt. is not sol. in NH_3 as is the Ni ppt.

A. W. DOX

General directions for the sampling of ores. A. GRAUMANN. *Metall. u. Erz* 18, 97-99(1921).

R. S. DEAN

Determination of sulfur in iron, steel and pig. Methods for direct oxidation of the sulfur. ARCIBALDO CARTOCETI. *Giorn. chim. ind. applicata* 2, 682-6(1920).—C. reviews the various methods employed for detg. S in iron and steel (having in view accuracy of analysis) that are based upon direct oxidation of S to H_2SO_4 and pptn. as BaSO_4 . Preliminary investigation showed that the following conditions are necessary: (1) complete oxidation of the sample, avoiding thus a repetition of the treatment upon the residue; (2) complete freeing from HNO_3 ; (3) rendering SiO_2 insol. and sepg. it perfectly; (4) sepn. of Fe because the HCl soln. of FeCl_3 exercises a not negligible dis-

solving action upon BaSO_4 , besides contaminating it with basic Fe salt; (5) detn. of H_2SO_4 in an aliquot portion of the filtrate to avoid handling a voluminous ppt. of $\text{Fe}(\text{OH})_3$; (6) avoidance of an excess of HCl , which otherwise renders the pptn. of BaSO_4 incomplete; (7) pptn. in the hot, with quick addition of BaCl_2 and continual agitation. C. devised the following method. Mix 10 g. sample in shavings or filings, 2 g. KClO_3 and treat in a porcelain dish with 100 cc. concd. HNO_3 to which has been added 2 cc. Br . Soln. should take place slowly; the acid should be added in several portions, and strong heating of the liquid should be avoided by placing the dish in cold water. When gaseous evolution has ceased, add 20 cc. concd. HCl , and evap. on the sand bath to dryness with agitation towards the end of the reaction to avoid spurting. Remove the sand from the bath, replace the dish, and heat to redness to decompose nitrates and complete the oxidation. Allow to cool, take up with 50 cc. concd. HCl , and evap. anew. Take up once more with 50 cc. HCl , evap. to a sirupy consistency, dil. the soln. with a little H_2O , and allow to cool. Pour the liquid, with continual agitation, into a 1000 cc. graduated flask contg. 300 cc. 10% NH_4OH . Wash the dish well with H_2O , and add the washings to the liquid in the flask. Shake energetically. Allow to cool, and bring to vol. Mix again by pouring back and forth between the flask and a dry beaker. Allow the voluminous ppt. to deposit well and filter upon a dry filter. Take 500 cc. of the filtrate, and reduce its vol. by evapn. to about 200 cc. Bring to boiling and ppt. the H_2SO_4 with 20 cc. 10% BaCl_2 previously brought to boiling, while agitating continually in one direction. Allow to stand for about $\frac{1}{2}$ hr. on the water-bath, pour the supernatant liquid upon a filter, wash the ppt. by decantation 3-4 times by 100 cc. portions of boiling H_2O , then bring the ppt. upon the filter and wash with hot H_2O until 5 cc. of the filtrate fail to give a turbidity with H_2SO_4 . Burn the moist filter in a Pt dish, ignite moderately, cool and weigh.

ROBERT L. POSMONTIER

Sensitive test for hydrides of arsenic, antimony and phosphorus (ZIMMERMANN) 17. The microchemical determination of nitrogen (STANĚK) 28.

Gas analysis. E. K. RIDEAL and H. S. TAYLOR. U. S. 1,375,933, Apr. 26. See C. A. 14, 714.

8—MINERALOGICAL AND GEOLOGICAL CHEMISTRY

EDGAR T. WHERRY AND WALTER F. HUNT

"Allemontite" from Atlin, B. C. T. L. WALKER. Univ. Toronto. *Am. Mineral* 6, 97-9(1921).—The material studied came from the Engineer mine, which yields very rich Au-ore. Fumes from a wine cask in which the specimens were packed tarnished some layers of the mineral red-brown, others remaining steely or white metallic. Analyses of 4 samples showed the most tarnished layers to be highest in As: As, 87.98, 82.54, 70.08, 42.69; Sb in same, respectively, 10.97, 17.74, 28.68, 57.06%. There is a regular increase in sp. gr. with % of Sb, and the sp. gr. calcd. from the constituents agrees with the observed values, showing that the As and Sb are not combined, which is confirmed by mineragraphic examn. The formula for "allemontite" given in the literature, As_2Sb , is evidently without significance, the material being merely a mechanical intergrowth of the elements. The special name should be discarded, and replaced by "*antimoniferous arsenic*."

E. T. W.

Specific gravity and composition in iron-rutile. EDW. F. HOLDEN. Pa. State Coll. *Am. Mineral* 6, 100-3(1921).—Previous work on Fe-bearing rutile indicated it to be an isomorphous mixture of TiTiO_3 with sp. gr. 4.20 and FeTiO_3 with sp. gr. 5.00 \pm 0.25. H. has endeavored to obtain more accurate values for these sp. grs. using

the 7 most dependable analyses found in the literature. The sp. gr. of each mixt. was calcd., by the formula $D = d + a(d' - d)/100$, where D is the sp. gr. to be detd., d and d' those of the end members, and a the vol. % of the FeTiO_3 present. Any Fe_2O_3 shown in analyses was recalcd. to FeO , and impurities deducted, followed by recalcn. to 100%. Calcns. were made with 3 values for rutile, 4.22, 4.23, and 4.24, and with 5 values for FeTiO_3 , 4.75 to 4.79. The differences between observed and calcd. sp. grs. were detd., and the sums of their squares found. This sum proved to be least for the values 4.23 for TiTiO_3 and 4.77 for FeTiO_3 , the probable error being ≈ 0.03 . Plotting the sp. gr.-compn. curve shows linear relations, and confirms the isomorphous character of the material.

E. T. W.

The Silver Horn district near Pioche, Nevada. T. H. M. CRAMPTON. *Mining Sci. Press* 122, 883-4(1921).—A replacement ore body exists which is 10-200 ft. wide and exposed for a length of 2000 ft. The quartz lies between brown and dark blue limestone. Extensive movement along the contact has formed a breccia which was replaced by solns. carrying Au and Ag. Subsequent shearing across the ore body has also produced enriched zones.

A. H. HELLER

The Kantishna mining district, Alaska. JAMES A. HANEY. *Mining Sci. Press* 122, 881-2(1921).—A description of the district including power and fuel, topography, geology, lodes, placers, production and future of the district. The more important minerals that have been recognized are Au, Ag, galena, tetrahedrite, stromeyerite, chalcocopyrite, stibnite, sphalerite, arsenopyrite and pyrite.

A. H. HELLER

The deposits of magnesium carbonate in Spain. E. DUPUY DE LÔME AND C. F. MAQUHIRA DE BORBON. *Bol. Inst. Geol. España* 39, 255-95(1918); *Rev. géol.* 1, 200 (1920).—The deposits of *giöberite* in Almeria and Santander are described as to location, geology, mode of occurrence and origin.

E. T. W.

A Pliocene deposit of phosphate in the vicinity of Rabat, Morocco. A. BRIVES. *Compt. rend. somm. soc. géol. France* 1917, 95; *Rev. géol.* 1, 201(1920).—About 15 km. southeast of Rabat phosphate beds have been discovered containing up to 46.8% $\text{Ca}_3(\text{PO}_4)_2$. Their geologic position can be recognized by the fossils present, and it is queried if they have not been formed by the erosion of earlier deposited phosphatic beds.

E. T. W.

The supposed phosphate deposit in the vicinity of Rabat, Morocco. L. GENTIL. *Compt. rend. somm. soc. géol. France* 1920, 25; *Rev. géol.* 1, 201(1920); cf. preceding abstract.—Analyses of the deposit showed only 3.60 to 5.15% of $\text{Ca}_3(\text{PO}_4)_2$, much less than has been previously reported. The phosphates have arisen by the breaking up of fossil shells.

E. T. W.

Permian salt deposits of the South-Central U. S. N. H. DARTON. U. S. Geol. Survey, *Bull.* 715-M, 205-23(1921).—This deposit extends fully 650 miles north and south, and 150 to 250 east and west through New Mex., Tex., Okla., and Kan. It is of variable thickness but in many places over 300 ft. and is the largest known salt deposit in the world. The deposits in each state are described, with the logs of many borings. "The salt beds of this great deposit doubtless originated in the evapn. of ocean water occupying a basin or series of basins for a considerable part of Permian time. The irregular distribution of the gypsum and anhydrite in relation to the salt indicates remarkable oscillations in short lines and complexity of local conditions, and the presence of limestone beds at intervals shows that deeper marine submergences occurred from time to time. It is certain that a considerable supply of sea water was necessary for the accumulation of deposits of salt several hundred ft. thick over a vast area. A figure of interest in this connection is the fact that a body 100 ft. deep evapg. to dryness deposits the greater part of its CaSO_4 , amounting to about 2 in. under ordinary conditions, and then deposits about 3 ft. of NaCl . That the waters were shallow much of the

time is shown by the large amt. of shale and sandstone present, in part mixed with the salt. Most of these sedimentary materials are red, but some are gray and other tints."

L. W. RIGGS

Study of a physicochemical phenomenon in brines of Santa Elena. L. E. TAMAYO. *Bol. lab. municipal. Guayaquil* 1, 66-8(1920).—The deposition of NaCl from the brines of Santa Elena, which is surrounded by the ocean for an extent of about 6.8 mi., occurs by an infiltration of the sea water into excavations 4 to 6 ft. deep and about 10 to 80 sq. yds. in area. The brines in these excavations are further augmented by leachings from the plains surrounding them which are flooded by heavy rains. This causes an increase in the concn. to about 5° Bé of the brines, which exceeds the concn. of the sea water which is about 3.6° Bé. The analysis of the crude product from the solar evapn. of the brines is as follows: White salt sample, NaCl 93.35; CaSO₄ 0.28; MgSO₄ 0.30; MgCl₂ 0.52; H₂O 5.0; insol. matter 0.10%. Reddish gray salt sample: NaCl 88.5; CaSO₄ 0.65; MgSO₄ 0.65; MgCl₂ 1.33; H₂O 6.90; insol. matter 1.20%. In some of the excavations crystn. ceases. Since no removal of the mother liquors is made, it is probable, judging from the above analysis, that the concn. of salts, particularly of salts of Mg, is so great that further crystn. of NaCl coming in through infiltration of new brines, is not possible. A concn. of 34° Bé. was observed in some of the excavations. The phenomenon was not observed where the mother liquors are drained away. In such cases dialysis of the Mg salts occurs through the bottom of the pits, when refilled by infiltration of the sea water and NaCl continued to crystallize as before. Impermeability of the muddy bottoms of the others probably prevents the dialysis of the Mg salts, for which removal of the mother liquors and cleaning out accumulated mud deposits lead to a resumption of normal operations, though some were not benefited by such a treatment. This impermeability is thought to be brought about in the following way. The saline waters dissolve salts of Ca from the surrounding soil, which is calcareous in nature, and form and deposit crystals of anhydrous CaSO₄ which is also formed in waters of the pits from the action of MgSO₄ and Na₂SO₄ upon CaCl₂ contained in the mother liquors. T. believes that the excessive concn. of CaCl₂ prevents the crystn. of NaCl. It suggested that the CaCl₂, being so hygroscopic, prevents the mother liquors from attaining the concn. where NaCl crystals will form, since evapn. is interfered with.

R. B. DEEMER

New Salem lignite field, Morton County, North Dakota. EUGENE T. HANCOCK. U. S. Geol. Survey, *Bull.* 726-A, 1-39(1921).—N. Dak. lignite because of its inferior qualities has received but little attention until the era of recent high prices. The new Salem field included in this survey covers 20.5 townships a short distance west of Bismarck. Analyses of 17 samples of N. Dak. lignite as taken from the mine show an air drying loss ranging from 11. to 35.6%, moisture 28.1 to 44.0, vol. matter 23.8 to 31.1, fixed C 24.9 to 36.1, ash 5.0 to 10.5, S 0.22 to 1.53, B. t. u. 6010 to 7360. Three New Salem samples included in the above analyses give figures about an average of the 17 samples reported. The amt. of coal in the New Salem field is estd. to be 2 billion 68 million short tons.

L. W. RIGGS

Origin of oil. H. W. HIXON. *Oil and Gas J.* 20, No. 3, 78(1921).—Polenic with Fairchild (cf. *C. A.* 15, 2494). H. claims that the diffusion of gases in a gaseous planet will account for the presence of hydrocarbon gases in a gaseous interior of the earth. The salt domes may be the result of sublimation from the gaseous interior of the earth and while they may not be volcanic, they have the same ultimate cause. Dry holes and productive oil fields should not be close together if the org. theory of petroleum formation is true. Certain differences between org. and petroleum oils are cited against the org. theory.

R. L. SIBLEY

Geology and petroleum resources of northwestern Kern County, California. W. M.

THE A. ENGLISH. U. S. Geol. Survey, *Bull.* 721, 1-45 (1921).—This study is practically confined to the areal geology and the relations of developed fields to the possibilities of finding oil in untested areas.

L. W. RIGGS

Preliminary report on petroleum in Alaska. GEORGE C. MARTIN. U. S. Geol. Survey, *Bull.* 719, 75 pp. (1921).—During the period 1905-1919, over 275 million gal. of petroleum and its products were shipped to Alaska. The local production has been about 2 million gal., all from the Katalla field. Data from geologic surveys and the few drilled wells do not indicate that great deposits exist, but oil in paying quantities may be found. The Katalla, Yakataga, Cook Inlet, and Arctic Peninsula Fields are described. Extensive prospecting work is now under way.

L. W. RIGGS

The well at Caldones, Asturias. MANUEL RUYS-FALCO. *Bol. Inst. geol. España* 37, 3-28 (1916); *Rev. géol.* 1, 201 (1920).—At a depth of 560 m. abundant combustible gas was struck, with the compn.: H 0.46, CH₄ 95.51, C₂H₆ 2.14, N 1.89%. Its calorific value ranged from 8.590 to 9.553 calories.

E. T. W.

The mineral facies of rocks. PENTTI ESKOLA. Univ. Christiania. *Norsk Geol. Tid.* 6, 143-194 (1920).—(In English). An attempt to develop a *natural classification of rocks* based primarily on equil. relations between the minerals present, extending work in one region in Finland (*C. A.* 14, 2605) to rocks in general. The term *facies* is given to a characteristic assemblage of rock-minerals. These minerals are termed critical when they are stable only in a given facies, and typical when they occur also in others. Any rock may also contain minerals which are really unstable, being either relics of some earlier stage in the crystn. of the magma, or posterior products (often though less correctly called secondary). Among metamorphic facies 5 chief types can be distinguished, provisionally termed the sanidinite, hornfels, green-schist, amphibolite, and eclogite facies. An analysis representing each of these is quoted, and the dominant minerals present are listed. The critical minerals for each are respectively: sanidine feldspar with clinoenstatite-diopside; a hypersthene-diopside association; chlorite-muscovite and epidote-albite associations; hornblende or other amphiboles; and garnet approaching pyrope with jadeite or jadeite-pyroxene. It is instructive to express the relations between chem. and mineral compn. graphically. As the largest available diagram is triangular, it is necessary to select or group the rock-constituents. At the top of the triangle is located the Al₂O₃ not combined with K₂O or Na₂O, abbreviated to A; at the lower left corner the CaO, (C) and in the lower right the MgO + FeO, (F). Such an "A-C-F" projection is given for each of the facies above named, analyses when available being located by points in the diagram and lines drawn to show the boundaries of fields in which various critical minerals are stable. The minerals which occur in the rocks are thereby shown to have very definite relationships to the chem. compn. some of which have in fact been confirmed experimentally. Among igneous rocks there are facies corresponding to the above listed metamorphic ones, resp. the diabase, gabbro, felsite, hornblende-gabbro and igneous-eclogite facies. The last is especially important in petrologic theory, and should be further investigated. The bearing of these studies on the "quant. classification of igneous rocks" is discussed. The rules for calcg. the norm in this system aim at reconstructing a facies approximating the hornfels or gabbro. "If the authors had clearly realized the fact that it was the system of minerals in a definite chem. equil. that they wanted, the rules of the norm calcn. would probably have been somewhat different. But even as it is the norm system must be regarded as exceedingly successful." Some minor improvements in the assignment of constituents to normative minerals are suggested. "If the norm was a successful characteristic of potential mineralogical features in the rocks, it is then the more regrettable that the authors of the quant. classification soon departed from the chemico-mineralogical line.... and went on to develop a merely arithmetical system..."

Boundary lines in the gradual variation of the chem. rock compn. where new minerals appear are, in every facies,... such natural boundaries that they should have been accepted with thankfulness as a basis of detailed grouping. Within such boundaries quant. proportions could have been used." However, E. thinks that on the whole a classification based entirely on the facies principle would be still better. E. T. W.

Mineralogical and chemical study of an amphiboliferous epidotite. S. PIÑA-DE-RUBIES AND R. SABOT. *Bol. Soc. españ. Hist. Nat.* 15, 194-9(1915); *Rev. géol.* 1, 182(1920).—The results of analysis and optical study are given of a rock from the summit of Mt. Semichelloviechui, Urals. E. T. W.

Ground water in the Meriden Area, Connecticut. GERALD A. WARING. U. S. Geol. Survey, *Water-Supply Paper* 449, 80 pp.(1920).—The area comprises 6 towns, located near the center of the state. The nature and quantity of the water in the stratified drift, till, Triassic rocks, trap rock, and cryst. rocks are described, and the results of chem. analysis by S. C. Dinsmore of the water of more than 40 wells and springs are tabulated. Nearly all of the waters are of the CaCO_3 type; total solids ranging from 80 to 367 parts per million, average 181. In general, waters from sandstone and trap were more highly mineralized than those from the glacial drift, the increase being caused by more Ca and Mg salts. In about one-half of the waters the ratio Mg:Ca was 1:3. The content of Na and K was low in all cases. In addition to the study of chem. characters, descriptions of well construction, logs of drilled wells, and possibilities of increased supply are given. L. W. RIGGS

Ground water in the Southington-Granby area, Connecticut. HAROLD S. PALMER. U. S. Geol. Survey, *Water-Supply Paper* 455, 213 pp (1921).—This area comprises 18 towns in the northwest central part of the state. A description of the geographic and geologic features given includes 9 mechanical soil analyses. Various pumps and water-lifting devices are described and illustrated. Chem. analyses in connection with this study include 50 assays and 31 analyses by S. C. Dinsmore, 4 analyses by A. H. Chambers and 3 analyses by others. Methods of analysis were substantially those of Dole (cf. *C. A.* 4, 736) and of assay those of Leighton (cf. *Water-Supply Paper* 151). Results based on assay figures were not so accurate as those based on analysis, but it was found that the classification of a water for domestic, boiler or irrigation purposes was nearly always the same whether based on an analysis or an assay. L. W. RIGGS

9—METALLURGY AND METALLOGRAPHY

D. J. DEMOREST, ROBERT S. WILLIAMS

Notes on the influence of soluble silica and calcium salts on precipitation. J. HAYWARD JOHNSON. *J. Chem. Met. Soc. S. Africa* 21, 151-3(1921); cf. *C. A.* 15, 652, 1874. —A soln. containing 0.05% KCN and 0.17% SiO_2 , the latter in the form of water glass, was kept in contact with powdered quartz, powdered pyrite, granulated Pb, Zn shavings, and Pb-coated Zn. Pptn. occurred only with the latter. After 12 hrs. contact the dissolved SiO_2 was reduced to 0.02%. The gelatinous ppt. formed consisted chiefly of SiO_2 and Zn(OH)_2 . Sodium zincate is regarded as a colloidal soln. of Zn(OH)_2 , which is very unstable and rapidly deposits Zn(OH)_2 as a gelatinous ppt. In pptg. it might be expected to bring down SiO_2 . H. C. PARISH

The flotation process of ore dressing. EUGEN RYSCHKEWITSCH. *Chem.-Ztg.* 45, 478-9(1921).—The first German flotation patents pertained to the sepn. of graphite from its ores. For this purpose the graphite was mixed with oils, fats or hydrocarbons and then water was added and the whole brought to boiling, whereby a graphite froth was formed on top. Variations of this process have been used. R. cannot agree with

the views of Callow as accepted by Simmersbach (C. A. 15, 2052) that the positive particles float and the negative particles sink, since it can be shown experimentally that particles of graphite, sulfides and metals are negative in water suspension. The flotation process is best explained by adsorption phenomena. The difference of adsorption on gang minerals and metallic minerals is due to a difference of structure. The space lattice of gang minerals is made up of mols., that of the metallic minerals of ions. The metallic minerals, therefore, have a residual valence or unbalanced static force at the surface which is responsible for adsorption. Unsaturated substances are more readily adsorbed than saturated ones; hence ketones, aldehydes and unsaturated hydrocarbons are better frothing agents than saturated compounds.

R. S. DEAN

Design and proportions of hot blast stoves. W. E. GROUNE-GRJMAILLO. *Iron Age* 107, 1527-30, 1613-6, 1677-80 (1921).—Faults of Cowper, Moore, Withwell, and Becker stoves are discussed. To meet requirements the flaming gases must be held within the combustion chamber for a calculated period, thereby producing maximum wall temperature. Directing gas and air currents upward into the dome would prevent too rapid downward passage common to stoves receiving horizontally. Vertical combustion chambers should be covered with an arch of calculated size and provided with orifices for gas escape, thus permitting building of checkerwork higher into the dome. The survival of Bessemer and Cleveland iron tube hot blast stoves shows that they have correct circulation of gases. Distribution of gases follows natural laws and can be changed by insulation only. Changing the height of bridge wall or dome, or increasing the number of chimney valves will not affect distribution if one chimney valve has sufficient area, although insufficient valve area is a common fault. Temperature differential between gas and brickwork, volumes of chambers, velocities of gases, frictional resistance to passage of blast, average heat absorption, heat capacities of waste gases, and brick and pass volume calculations are shown. Nine tables and 21 figures are included.

G. R. J.

Commercially pure iron in the basic open hearth. W. J. BECK. *Iron Age* 107, 1462-4 (1921); *Chem. Met. Eng.* 24, 865-8 (1921); *Blast Furnace and Steel Plant* 9, 345-8 (1921).—Impurities were removed by holding the metal in the furnace longer and at higher temperature than is the usual practice. More than the usual amount of aluminum was found necessary for proper degasification and deoxidation. High temperature shortened the life of the furnaces, increasing costs. Since some elements, Cu, As, Sb, Sn, Ni and Co, are not eliminated in open-hearth furnaces, ores free from them must be used. The pure iron must be rolled above the critical range (about 900°C) on blooming mill and below on bar mill. The intermediate cooling thus required is expensive. Lower temperature rolling on sheet mill is necessitated by the tendency of the sheets to weld together. Proper annealing conditions are determined by the microscope. The product is superior to steel for: galvanizing, solution in spelter, and rust resistance. It finds a demand in the form of welding wire and rods and for enamelled products. Average analysis for year is 99.865% Fe based upon 9 impurities.

G. R. J.

The reaction of sulfur in the Thomas (basic) converter. F. HERZOG. *Stahl u. Eisen* 41, 781-88 (1921).—The following conclusions are drawn regarding the action of S in the basic converter charge: The addition of lime together with the coincident cooling of the bath accomplishes a considerable segregation of the S as MnS. In the further run of the decarburizing period the S goes back into the bath as FeS since the segregated MnS cannot exist in the still acid slag. The slag becomes sufficiently basic to retain the MnS only about the middle of the after-blow.

R. S. DEAN

The Siemens regenerative gas reverberatory furnace with division of the flame. ARTHUR SPRENGER. *Stahl u. Eisen* 41, 749 (1921).—A description with diagrams of the new regenerative reverberatory furnace according to D. R. P. No. 310398.

R. S. DEAN

Manufacture of molybdenum steel. POKORNY. *Z. Metallkunde* 12, 238-9(1920).

On account of the readiness with which Mo oxidizes and the easy soly. of the oxide in the solid metal, the best way of adding Mo to steel is as a ferro-Mo alloy contg. about 45% Mo, which has been melted electrically and carefully deoxidized. The best deoxidizers for such steels are Ti and V, as they act also as N scavengers, their nitrides being readily volatilized, whereas when Al and Si are used, difficultly volatile nitrides of Mo are formed. The double Fe Mo carbide is very sparingly sol. in molten Fe; it is, therefore, advisable in prepg. Mo steels to add to a bath low in C the required amt. of a low-carbon ferro-Mo and then to carburize the metal up to the required C content.

J. S. C. I.

Value of zinc in the ore and the economic basis of its recovery. PAUL. *Metall u. Erz* 17, 439-49, 475-578, 514-9(1920); 18, 59-66, 126-35(1921).—The customary formula on which Zn ores are sold is $V = P(t-8) - K$, where V is the value of 1000 kg. of the ore, t is the zinc content %, P is the market price of one unit (=10 kg.) of spelter, and K is the returning charge. The latter varies with the nature of the ore, and P shows that it should be higher for roasted ores than for raw blende in a proportion which is greater the higher the S content and the price of spelter and the lower the Zn content of the original ore. With equal returning charge the value of Zn in an ore per unit increases rapidly with the Zn content; on the other hand low-grade ores may become of negative value when the price of Zn is low (cf. *C. A.* 13, 949). The above formula is examd. from every point of view and reasons are advanced to show that it does not fairly represent the value of an ore. Thus the returning charge is the same for rich and poorer ores, while the proportion of "free" units is relatively smaller with rich ores, and hence there is not such a great proportionate margin for losses; therefore the richer ores are dearer than they should be in relation to the poorer. Again the cost of smelting depends not on the amt. of ore smelted, but on the capacity of the furnace, and this varies according to the apparent sp. gr. of the charge. No account of this is taken in the formula, nor of the value of the S. P. therefore suggests two new formulas, one for roasted and one for unroasted ores. In the case of sulfide ores a 1% loss of Zn on roasting is assumed and a loss in wt. of $(t_1 - 15)\%$, where t_1 is the S content of the ore. It is also assumed that 95% of the S removed is recovered as H_2SO_4 of 60° B. (sp. gr. 1.71). If the cost of roasting is approx. 15 M. per ton of roasted ore, while that of making a ton of H_2SO_4 is 8.5 M. and its selling price is 25 M., then the value of a unit (10kg.) of Zn in the ore in M. is given by the equation $V = 0.08415(P - E) - (115 - t_1)K/100\delta t_2 + (0.56878283t_1 - 24.275)/t_2$ where P is the market price of 100 kg. of spelter, E is the profit on every 100 kg. of Zn recovered, K is the cost of 1 cu. m. of retort room, δ is the apparent sp. gr. of the ore, t_2 is the Zn and t_1 the S content of the ore. With oxidized ores this simplifies to $0.085(P - E) - K/\delta t_2$.

J. S. C. I.

Refining Chinese bismuth concentrates. E. R. DARLING. *Chem. Met. Eng.* 24, 1108(1921).—Chinese Bi concentrates contain about 58% Bi_2O_3 , 5% Sb, and 0.14% As. They are refined by reducing to 80-mesh, dumping into vats, extg. with warm HCl soln. (prepd. by the action of H_2SO_4 upon a soln. of NaCl). After extn. and settling the liquor is drawn off and Sb and Bi are pptd. with Fe in another vat. The whole is filtered and the filtrate given a second extn. The Sb and Bi are washed, and dried in trays. The dried mass is treated with 15% HCl soln. to dissolve the Bi. The $BiCl_3$ is drawn off and added to a larger vol. of water to ppt. $BiOCl$. This ppt. is washed free from acid, dried, mixed with charcoal, Na_2CO_3 , CaO and CaF₂ and reduced to the metal in Fe crucibles.

W. H. BOYNTON

New testing machines. II. Hardness testing machines. H. IRION. *Z. Ver. deut. Ing.* 65, 315-20(1921).—Five new instruments for measuring the hardness of metals, four by the Brinell method and one by the Martens-Heyn method, are described. Three of the Brinell machines use hydraulic pressure for applying the load on the test

specimen. The other Brinell machine (for pressures of 750–1500 kg.) and the Martens-Heyn machine (for pressures of 250–500 kg.) apply the load through a graduated beam supporting a sliding wt. One of the hydraulic machines is designed for 50000-kg. pressures; the other two for pressures between 3000 and 5000 kg. The author studied the effect of varying pressures (20–3000 kg.) on the hardness of various materials, using balls 5 and 10 mm. in diam. If the depths of the indentation are plotted against their corresponding pressures a curve is obtained which has two branches, each a straight line. With a 10-mm. ball the slope of the upper branch is greater and with a 5-mm. ball less than that of the lower branch. I. found that the ratio of the tangents of the angles formed by these curves for balls 5 and 10 mm. in diam. with the pressure axis varied between 1.25 and 1.73, depending on the substance tested, and was always less than 2. The slope of the curve obtained with a 10-mm. ball was less than that obtained with a 5-mm. ball. This ratio shows that the hardness number obtained with a 5-mm. ball is larger than that obtained with a 10-mm. ball but is not twice as large. For pressures below 500 kg. the Brinell hardness number and the Martens-Heyn hardness number are the same if the detn. is made with a 6.35-mm. ball. On account of the change in the slope of the curve of pressure against indentation depth the relation expressed by Rudeloff that the pressure necessary to produce a certain indentation varies as the square of the ball diam. does not hold and cannot be used to compare the hardness values obtained with balls having different diameters. F. P. FLAGG

Studies on repeated shock. LEON GUILLET. *Rev. metal.* 18, 96–100(1921).—Failures under repeated shock are due to progressive cracking. High elastic limit and especially good heat treatment are necessary for good service. Data are given for Ni-Cr steels to show that with greater speed and height of fall a fewer no. of blows is required to break the specimen. Cementation decreases resistance to repeated shock, but increases it when followed by heat treatment. A small increase in the diameter of the specimen results in very large increase in the no. of blows to fracture. W. A. MUDGE

A study of hardness tests (Brinell method). R. GUILLERY. *Rev. metal.* 18, 101–10(1921).—Brinell values as ordinarily detd. are unsatisfactory because of variations in time of application and maintenance of load. By a special arrangement of automatic valves in a hydraulic machine the time factor may be eliminated and practically identical values obtained with forces of 100–3000 kg. sec. A special portable apparatus, similar to the scleroscope, is described. A definite mass, to insure good penetration, falls through a long tube with a force of 0.25 kg./m. The ball is 5 mm. in diam.; the controls are automatic. Tests can be made on any size of specimen with equal speed and accuracy. Diagrams and photographs illustrate both pieces of app. W. A. MUDGE

X-rays and the structure of metals. J. LAUB. *Anales soc. quim. Argentina* 7, 296–303(1919).—A brief general discussion. L. E. GILSON

Pipe and blow-hole formation in copper ingots. W. STAHL. *Metall u. Erz* 18, 57–9(1921).—Pipe formation in dense gas-free copper castings is due to the crystn. starting at the sides of the mold and drawing the metal away from the center. This may be prevented to some extent by using a hot mold or an insulated mold so that the heat is not so rapidly extd. at the sides or better by feeding while cooling so as to fill up the pipe. It has not been definitely proved that the addition of various metals or metalloids has any effect on pipe formation. P and Al seem to increase it while Ni, Co, Fe and Si decrease it. The effect of absorbed gases which are always present in fire-refined copper is to decrease pipe formation by causing expansion on solidification. If, however, they are present in large amts. a pipe is formed which is a gas cavity rather than a real shrinkage pipe. R. S. DEAN

The theory of metallic alloys and its principal industrial applications. LEON GUILLET. *Chimie & industrie* 5, 371–83, 500–7(1921).—Fourteen theoretical equil.

diagrams (temp. and compn.) of binary alloys are given and briefly discussed. Their importance and applications to industrial metallurgy are illustrated by means of 28 diagrams of various alloys and compds.

A. P. C.

Equilibrium between metal pairs and sulfur. I. The system copper, lead and sulfur. K. L. MEISNER. *Metall u. Erz* **18**, 145-153(1921); cf. *C. A.* **14**, 3051.—The triangular diagram is divided into three smaller triangles by the lines Pb-Cu₂S and PbS-Cu₂S. In the first triangle Cu-Pb-Cu₂S only the 3 kinds of crystals exist. In the binary system Cu-Pb there is a region of partial miscibility from 35 to 85% lead; with the system Pb-PbS a similar region exists from 5 to 19% S. Inside of this triangle there is a region of partial miscibility in which theoretically 3 liquid layers should occur. Actually there is an emulsion of the 2 lower layers. Cu and Pb may, therefore, be made practically miscible by the addition of 1-1.5% S. In the second triangle Pb-Cu₂S-PbS there is a region of partial miscibility which falls very near the line PbS-Cu₂S. Without the addition of Pb there is no region of partial miscibility, only a eutectic mixt. Finally in the last triangle PbS-Cu₂S-S the mixts. except in the vicinity of the line PbS-Cu₂S cannot be prepd. by melting without decompn. The sulfur-rich mixts. have not been closely investigated but it has been detd. that the line PbS-CuS represents not a quasi-binary series but an equil. between PbS, CuS and the dissociation products of CuS.

R. S. DEAN

Thermal expansion of copper and some of its important alloys. PETER HIDNET. *Bur. Standards, Sci. Paper No. 410*, 159 pp. (1921).—An exhaustive investigation was made of the thermal expansion of 128 samples of Cu and its important industrial alloys. The alloys contained various percentages of Cu and were prepd. in various ways, cast, cast and cold-rolled, extruded, extruded and cold-worked, hot-rolled, and hot-rolled and cold-worked. Samples were examd. from -50° to +300°. Practically all the available information on thermal expansion of Cu and its alloys is briefly reviewed and a description of the app. and the prepn. of the samples is given. Definite mathematical relations were found to exist between the instantaneous coeff. of expansion and the copper content of most of the alloys investigated. Conclusions derived were that the coeff. of expansion increases as the content of Cu decreases, and that additions of Pb generally decrease while additions of S generally increase the coeff. E. G. JARVIS

Copper and brass. J. F. SPRINGER. *Brass World* **17**, 157-60(1921); cf. *C. A.* **15**, 359.—A consideration of the light colored metals from early times to the present

C. G. F.

The hot working of brass. A. DEVILLIERS. *Technique moderne* **13**, 206-9(1921).—In a brass of given Cu content, the lower temp. limit of the working range is raised and the upper limit lowered by an increase in the amt. of impurities. The impurities other than Pb (Fe and Sn) are generally less than 15% of the amt. of Pb and their influence is almost negligible in comparison with that of the latter; so that in practice the limits of the working range depend on the Pb content. In practice the temp. is usually gaged by the eye, and it is necessary to choose conditions so that the working range shall be fairly large so as to allow considerable variations in the temp. without getting out of the working range; it should be at least 100°. To this range corresponds a definite Pb content, which is called the "critical Pb content." If the amt. of Pb increases above the critical value, the alloy can still be worked, but the amt. of waste becomes excessive. Batches of given Cu content but varying Pb content were worked, and, assuming 5% as a reasonable amt. of waste, the Pb content above which there was more than 5% and below which there was less than 5% of waste, was considered to be the critical point. The batches were large enough to eliminate accidental variations. Curves are given for the "critical Pb content" of ordinary brass and of brass containing 0.12, 0.25, 0.50, and 1.0% Al for various methods of working (rolling, punching, drawing.

etc.). For a given Cu content, the presence of Al raises the critical point, and for a given critical point it raises the % of Cu. A. P.-C.

Commercial chromium alloys. J. HÉBERT. *Inst. Polytechnique de l'Ouest. Technique moderne* 13, 197-205(1921).—An outline is given of the occurrence of *Cr* ores and their methods of analysis, of the manuf. of metallic *Cr*, of the manuf., purification, properties, and methods of analysis of ferro-*Cr*, silico-*Cr*, and ferro-silico-*Cr*; of the properties of *Cr* steel, the properties and uses of Ni-*Cr*-steels, the properties of various *Cr* steels (*Cr*-V, *Cr*-W, *Cr*-W-Mo, *Cr*-W-V), and the *detcn.* of *Cr* in steels; and of the use of *Cr* salts, especially dichromates. A. P.-C.

The determination of electric resistance of alloys lead-tin and lead-zinc at high temperatures. SEIBEI KONNO. *Sci. Reports Tohoku Imp. Univ.* (Sendai, Japan) 10, 57-74(1921).—The elec. resistance of two series of alloys Pb-Sn and Pb-Zn was measured by a potentiometer method during heating and cooling above and below their melting points. From the resistance-temp. curves thus obtained the equil. diagrams of the alloys were *detcn.* They coincide almost exactly with those obtained by thermal analysis. The rate of sepn. of solid soln. during solidification was *calc.*, both from the resistance-temp. curves and from the equil. diagram and the results obtained by the two methods showed good agreement. F. P. PHELPS

Iron-pot melting practice for aluminium alloys. I. ROBERT J. ANDERSON. *Metal. Ind.* 19, 189-90(1921).—This is the first of a series of articles on the melting of Al alloys, giving a complete survey of present day methods in general and a detailed investigation of iron-pot furnaces in particular. In general the most suitable pouring temp. for Al alloys is 816° (1500° F.). O. A. HOUGH

The use of very slow rates of cooling for the micrographic study of alloys and the structure of tungsten steels. A. PORTEVIN. *Compt. rend.* 172, 964-7(1921).—Exceptionally slow rates of cooling are useful in many ways. They enlarge the structural pattern, assist in the *detcn.* of equil. points in alloy steels, and bring out conditions previously unsuspected by producing new equil. structures. In studying tungsten steel by this method P. comes to the following conclusions: Tungsten steels are composed of 4 constituents: a tungsten-ferrite, some tungsten-carbide, a tungsten-troostite and a new constituent which is a complex ferrite + Fe_3W . The three components are the solid soln. $\text{Fe-Fe}_3\text{W}$, the carbide WC, and the compd. Fe_3W . This corresponds with the equil. in the Fe-W-C system. F. W. COBB

Absorption power of different steel for X-rays. R. HADFIELD, S. A. MAIN, AND J. BROOKSBANK. *Trans. Faraday Soc.* 15, Pt. 2, 74-5(1920); *Science Abstracts* 23A, 437-8.—Reproduction of some radiographs of disks of steels, quenched or annealed, illustrating early expts. on distinguishing different steels. H. G.

X-ray examination of steel. R. HADFIELD, S. A. MAIN, AND J. BROOKSBANK. *Trans. Faraday Soc.* 15, Pt. 2, 72-73(1920); *Science Abstracts* 23A, 437.—The great metallurgical possibilities of X-ray examn. are limited by the penetrability of the masses of metal; 4 in. seems to be the max. thickness of steel so far penetrated. The non-destructive character of the test is a great advantage; but the app. required is costly and delicate, and microscopic defects are not magnified; fluorescent screen methods should in general be able to replace photographic methods. The X-rays might elucidate the allotropy problem. H. G.

The computation of the eutectic points and the limits of solution in systems containing iron. KARL DARVES. *Z. anorg. allgem. Chem.* 115, 290-2(1921).—In binary systems of Fe with C, Ti, P, As and B the points representing the limits of soly. and the formation of an eutectic can be expressed (as mol. fractions) by integral multiples of the fraction $\frac{1}{4}$. It is assumed that the elements or compds. present be considered with the mol. wt. each has in that system. For example in the Fe-C system by considering

Fe trivalent and Fe_3C as univalent the relation for the eutectic compn. is $\frac{1}{4}$ mol. $\approx 64.2\% \text{ Fe}_3\text{C} = 4.29\% \text{ C}$. This law is probably of much more general application and from it additional relationships can be deduced; e.g., the eutectic point seems always to be represented by the mol. fraction $\frac{1}{4}$. This relationship may serve to check the diagrams of various systems and give an insight into mol. structure. F. P. FLAGG

The change of the moduli of elasticity and rigidity in carbon steels by quenching. KOTARO HONDA AND HITIRO HASIMOTO. *Sci. Reports Tohoku Imp. Univ.* (Sendai, Japan) 10, 75-7(1921).—It is well known that the hardness and tensile strength of C steels increase markedly by quenching. Contrary to the expectation of H. and H. the moduli of elasticity and rigidity are found to decrease on quenching. On annealing the quenched specimens the moduli were found to increase. A similar effect is noticed in the case of special steels, such as tungsten steels and chromium steels. The effects can be satisfactorily explained by the theory of hardness put forward by Honda. F. P. PHELPS

The solubility of gases in molten steel. M. P. DEJEAN. *Bull. official direction recherches sci. ind. inventions* 17, 190-2(1921).—Dry O, N, and H were passed into molten steel in a crucible while in the furnace and the metal was cast into $90 \times 90 \times 630$ -mm. ingots. On cooling CO, N and O came off first, and H last. The ratio of gas in the metal after cooling is H 3, O 2, CO 2, and N1. CO is formed by interaction of O with C in metal, the amt. being directly proportional to vol. of gas added. Examn. of transverse sections of the ingot after cooling showed gas pockets grouped in the center and generally arranged perpendicularly to sides. W. A. MUDGE

A contribution to the knowledge of electrolytic iron. O. BAUER AND W. SCHNEIDER. *Stahl u. Eisen* 41, 647(1921).—The Brinell hardness of electrolytic iron is unchanged by quenching in ice water from temps. varying from 650° to 1258° . The av. hardness number is about 57. The iron was previously annealed at 950° for one-half hour. The breaking strength is likewise unaffected by quenching. These results are not in agreement with those of Boynton (*J. Iron Steel Inst.* 1906, 287) who found an increase of 100% in the hardness of electrolytic iron by quenching. Boynton, however, detd. hardness by the scratch method. R. S. DEAN

Forging tests on ingot irons. PAUL JUNKERS. *Stahl u. Eisen* 41, 677-87(1921).—Two ingot irons, material A with 0.13% C and material B with 0.50% C, were used in expts. designed to det. the influence of the reduction of cross section and the forging temp. on the mechanical properties and structure. To det. the influence of forging alone expts. were made in which the materials were compared after annealing alone and after heating and forging. The results of the expts. with material A may be summarized as follows: (1) The resistance to change of form decreases rapidly with increasing forging temp. (2) On the basis of mechanical properties 2 temp. ranges may be recognized, below 750° and above 750° . Below 750° the elastic limit increases with falling temp. and const. amt. of forging. The ratio of elastic limit to breaking strength approaches the value 1 with falling temp. of finishing. At the same time the expansion, contraction and toughness decrease. Above 750° the elastic limit decreases with increasing temp. more rapidly than the breaking strength. The expansion and contraction increase. (3) With a reduction in area of 50-85% at the same starting temp. the elastic limit and breaking strength increase with increasing forging, but the toughness, expansion and contraction all decrease. (4) The improvement in the properties through forging is greatest with the elastic limit, then with the breaking strength. Forging above A_{r_1} slightly increases the expansion and contraction. If the finishing temp. is below 750° the expansion is less than that of the annealed material. (5) The structure is of 3 kinds, depending on the temp. of finishing: below 750° the structure is that of a cold-worked metal; between 750° and A_{r_1} the structure is one of distorted ferrite grains; above A_{r_1} the solid soln. is formed. The results of expts. with material B may be summarized

as follows: (1) Different amts. of forging and different temps. produce the same properties in the material after subsequent annealing; only the toughness is increased. (2) The improvement in this material with forging is greater than with material A. (3) The structure of the forged and annealed material is finer-grained than that annealed only.

R. S. DEAN

Standard specifications of steels for bars, blooms, billets and flat plates. COMMISSION OF STANDARDIZATION. *Rev. metal.* 17, 469-83(1920). D. HALL

The function of insulation and its application to heat-treating furnaces. E. F. DAVIS. *Trans. Am. Soc. Steel Treating* 1, 33-42(1920).—The requirements of insulators from the viewpoint of efficiency are given. Heat loss from a horizontal surface is 22% greater than from a vertical surface.

W. A. MUDGE

Producer gas for heat treatment. GEO. H. TROUT. *Trans. Am. Soc. Steel Treating* 1, 51-5(1920).—Producer gas is recommended because of greater facility of manuf. and distribution, ease of control, and economy in use.

W. A. MUDGE

Dendritic steel. H. G. CARTER. *Trans. Am. Soc. Steel Treating* 1, 56-61(1920).—Photomicrographic evidence is given to show superiority of slow cooling over stripping of castings.

W. A. MUDGE

Steel for machine parts, stationary and moving, carbonized and heat treated. ROBERT M. TAYLOR. *Trans. Am. Soc. Steel Treating* 1, 67-72(1920).—Sixteen best heat treatments for different machine parts are given.

W. A. MUDGE

Fuels and their application to metal treating. W. A. EHLERS. *Trans. Am. Soc. Steel Treating* 1, 104-11(1920).—The true furnace efficiency is detd. by quality of work it produces and cost per unit of product and not relative cost per unit of fuel consumed. Proper furnace conditions are difficult to obtain with coal, coke or oil. Gas gives better results. Proper furnace construction is equally important.

W. A. MUDGE

Microconstituents in one section or a Metcalf test bar. O. E. HARDER. *Trans. Am. Soc. Steel Treating* 1, 111-6(1920).—The Metcalf test serves as a guide for detg. proper heat treating conditions. Photomicrographs show typical structures.

W. A. MUDGE

Time, temperature, and heating media functions in hardening tractor worms. J. L. McCLOUD. *Trans. Am. Soc. Steel Treating* 1, 116-26(1920).—The annealing time of a 0.40-0.50% C, 1.0% Cr steel was reduced from 12-20 hrs. to 2½ hrs. by heating to 100°-150° F. above the critical point (1540° F.), holding to relieve all forging strains and to allow all carbides to go into solu., cooling at a definite rate to just below the critical point, and quenching in boiling water. This method when used on oil-hardening gear stock gave better machining qualities, good physical properties, easier heat treatment and lower grinding cost. Complete data are recorded in many curves.

W. A. MUDGE

The efficiency of various quenching mediums and their application. VICTOR E. HILLMAN. *Trans. Am. Soc. Steel Treating* 1, 161-6(1920).—Brine imparts max. hardness. Water shows max. hardening power at 100° F., but lacks uniformity. Oils give excellent results if properly selected. Quenching high-speed steels in a molten chem. compd. at 1150° F. serves to combine quenching and drawing; it is productive of excellent results.

W. A. MUDGE

Stainless steel; its treatment, properties and applications. W. H. MARBLE. *Trans. Am. Soc. Steel Treating* 1, 170-7(1920).—Stainless steel finds many uses because of its resistance to corrosion and its physical properties. The standard compn. is: C 0.20-0.40, Cr 11.40-14.00, Mn not greater than 0.50, Si not greater than 0.30%, P and S, as low as possible. A properly hardened steel of the above compn. has a martensitic structure, with numerous globules of the double Fe-Cr carbides. Its hardness is directly proportional to the C content. If C is less than 0.25% the steel will not harden

successfully, if greater than 0.40% it is difficult to forge; Si neutralizes the hardening effect of C and permits higher C content, gives cleaner and sounder metal, and reduces ease of hardening; Mn acts as in ordinary C steels; P and S stimulate corrosion. Forging should be begun at 2100° F. and not carried below 1650° F.; annealing at 1400° F.; hardening in air, oil, or water from about 1750° F.; tempering to suit conditions of use. Cold working destroys its stainless properties and subsequent heat treatment is necessary to restore them. The physical properties will vary with different uses. The coeff. of expansion is 1.0915×10^{-6} . Etching with concd. HNO_3 and concd. HCl gives best results, although satd. FeCl_3 in HCl is good. W. A. MUDGE

Various quenching mediums and their application. W. G. LOTTES. *Trans. Am. Soc. Steel Treating* 1, 181-7(1920).—As a result of comparison between oil and water, L. advocates the use of hot water. Complete data are given. W. A. MUDGE

The electrical heat treatment of steel. H. P. MACDONALD. *Trans. Am. Soc. Steel Treating* 1, 198-207(1920).—The current is passed through the metal; this heats rapidly owing to its own internal resistance, and expands until a critical point is reached where expansion is either arrested or an actual contraction results. When contraction ceases and the temp. begins to increase the operator opens the pneumatic operating jaws, which allows the specimen to fall into a quenching bath. The same app. is used for drawback. Many charts, curves and photomicrographs are given to prove the following advantages: rapidity of heating; absence of scale, decarbonization and crystal growth; exact indication of temp. and critical point by physical changes in the metal; absence of refractories; freedom from warping; and lower cost of operating. The limitations are: const. size of metal to be treated; and large element of reactance when a. c. is used, which necessitates greater voltage at the transformer. W. A. MUDGE

Relative thermal efficiency of electric and fuel-fired furnaces. E. F. COLLINS. *Trans. Am. Soc. Steel Treating* 1, 217-27(1921).—Charts and curves give comparative losses and costs in favor of elec. heating furnaces. W. A. MUDGE

Pyrometers and their application to steel treating. J. D. ANDREWS. *Trans. Am. Soc. Steel Treating* 1, 229-38(1921).—The construction, standardization and use of recording, radiation, and optical pyrometers are discussed. W. A. MUDGE

High-carbon open-hearth steel versus crucible tool steel in the manufacture of miscellaneous tools. GEORGE PORTEOUS. *Trans. Am. Soc. Steel Treating* 1, 238-44(1921).—Arguments and tests are given to prove that equally good results are obtainable by the judicious use of open-hearth, high-C steel with proper heat treatment as from a higher grade and more expensive tool steel. W. A. MUDGE

Relative economy of oil, gas, coal and electric heated furnaces. SETH A. MOULTON AND W. H. LYMAN. *Trans. Am. Soc. Steel Treating* 1, 249-70(1921).—Advantages, disadvantages and comparative costs of installation, and operation are discussed in considerable detail. W. A. MUDGE

A new method of case-hardening steel. WILLIAM J. MERTEN. *Trans. Am. Soc. Steel Treating* 1, 270-3(1921).—Case-hardening is accomplished in a stream of $(\text{CN})_2$ evolved by heating an alkali cyanide. Nascent $(\text{CN})_2$ penetrates five times as rapidly as CO , permits better temp. control and gives finer, more uniform and deeper case. Cr, W, or Mn accelerates absorption of C owing to formation of double carbides, Ni and Si retard it. W. A. MUDGE

A discussion of molybdenum steels. CHARLES MCKNIGHT. *Trans. Am. Soc. Steel Treating* 1, 288-96(1921).—A comparison of ordinary C, Cr, Ni, Ni-Cr and Cr-V steels with and without Mo. Mo improves physical properties, gives wider range for practical heat treatment, higher drawing temp., higher impact value, wider forging range, and easier machining. These advantages tend to offset the higher cost. W. A. MUDGE

A research in case carbonizing. G. S. McFARLAND. *Trans. Am. Soc. Steel Treating* 1, 297-303(1921).—Comparison of a 10.18% C to 5.0% Ni, a 0.22% C to 0.50% Mn, and a 0.19% C to 0.74% Cr to 0.16% V steel. Ni steel is superior for single heat treatment and has better physical properties. Details and photomicrographs are given.

W. A. MUDGE

Hardening hammer die blocks. R. B. KERR. *Trans. Am. Soc. Steel Treating* 1, 309-12(1921).—Notes and precautions.

W. A. MUDGE

Progressive failure or fatigue of metals under repeated stress. H. F. MOORE. *Trans. Am. Soc. Steel Treating* 1, 327-30(1921); cf. C. A. 14, 1802.—Tests are made by rotating specimens in bearings, weights being hung on at two symmetrical points along length. Small ball bearings reduce friction to a minimum. The suspended weights set up bending in the specimen, compression along the top and tension along the bottom. When the specimen rotates 180° any given longitudinal fiber changes from compression to tension, a complete reversal of stress. A revolution counter gives the no. of cycles of stress. The machine runs at 1500 r. p. m. Elastic strength, ductility, amt. of initial stress after heat treatment and homogeneity of structure affect fatigue resistance strength.

W. A. MUDGE

True action of cyanide in case-hardening steel. G. R. BROPHY AND S. B. LEITER. *Trans. Am. Soc. Steel Treating* 1, 330-4(1921).—N has greater effect than C in cementation of steels by liquid carburizers, and causes greater embrittlement, though refining grain. Cyaniding greatly embrittles steel treated and this effect is more or less permanent. Ordinary anneal does not restore ductility. Parts resisting shock should not be so treated. Solid org. matter may have harmful effects. Cyanide baths as heating media will cause brittleness and may decrease the life of the steel. Photomicrographs show formation of nitride patches.

W. A. MUDGE

Tests of centrifugally cast steel. GEORGE K. BURGESS. *Trans. Am. Soc. Steel Treating* 1, 371-82(1921).—Segregation of C, P, S, Ni, and Cu exists to a slight extent but only radially, and is most marked in a narrow zone about $\frac{1}{16}$ " deep next to the inner surface. There is no segregation of Mn or Si. Max. C segregation was only 0.09% in a 0.66% C, 2.92% Ni steel. Brinell and scleroscope hardness practically follow segregation. Density across sections is practically const., the variation being 0.004 in 7.836 g./cc. Mechanical properties show greater strength and elastic limit and resistance to shock, but less ductility in tangential than longitudinal direction. Internal stress is of the order of the elastic limit with the outer zones in comparison. Proper heat treatment improves the properties to such an extent that castings are nearly as good as forgings of the same chem. compn. Microstructure is better than that of ordinary castings. Ni steels contain more slag and indicate that the centrifugal process may not clean up a basic steel. Complete numerical and photomicrographical data are given. Also in *Bur. Standards, Tech. Papers No. 192*, 22 pp.(1921).

W. A. MUDGE

First principles of the carbonizing process. A consideration of the fundamental facts and factors. THEODORE G. SELLECK. *Trans. Am. Soc. Steel Treating* 1, 383-97(1921).—The first of a series of ten articles. Historical review and general introduction.

W. A. MUDGE

Necessary precautions to obtain uniformity in the heat treatment of steel. H. C. LOUDENBECK. *Trans. Am. Soc. Steel Treating* 1, 398-401(1921).—Practical suggestions.

W. A. MUDGE

Manufacture of steel from raw materials to finished product. Remarks on heat treatment and fatigue failures. W. R. SHIMER. *Trans. Am. Soc. Steel Treating* 1, 423-35(1921).—A general description is given of processes with notes on necessary precautions. The paper is well illustrated with excellent photomicrographs. Some analyses and physical properties are given.

W. A. MUDGE

· **Making the most of high-speed steel.** A. E. BELLIS. *Trans. Am. Soc. Steel Treating* 1, 441-5(1921).—Brief historical review. Present general practice is to quench in a molten salt bath at about 1100° F., which gives the advantage of quench and draw in one operation.

W. A. MUDGE

Carburizing, hardening and tempering high-carbon alloy steels in 130 minutes. R. L. GILMAN. *Trans. Am. Soc. Steel Treating* 1, 445-8(1921).—A special automatic process is described.

W. A. MUDGE

Experiments on the corrosion of iron and steel. T. S. FULLER. *Trans. Am. Electrochem. Soc.* 39 (preprint).—F. observes the corrosive action of water on pure Fe and other metals by noting the behavior of drops of water upon evapn. Marked oxidation is evident after 15 min. Three well defined zones remain when the drop has completely evapd. The necessity of the presence of moisture to produce corrosion is indicated. The outer zone of the corrosion spot is called the "immune" zone; the inner zone comprizes the largest part of the area, and the "wall" zone lies between them. Corrosion velocity decreases as the corrosion continues, indicating a development of a partial immunity to corrosion by the first corrosion products. The effect of plugs of brass, monel metal and Zn, riveted in cold-rolled Fe blocks, upon distilled water corrosion of the Fe, when the drop partially covers the plug and the Fe, is illustrated by photographs. In each case, the rust extends over the edge of the non-ferrous plug. Small amts. of Al and Ca do not alter the initial corrosion rate, but Cr produces a marked inhibitive effect. Cu in steels has a marked inhibitive effect on corrosion (cf. Storey, *C. A.* 15, 1126) proportional to the Cu % present. Pure open-hearth Fe is the least affected in solns. weakly acid with H₂SO₄ (cf. Aupperle and Strickland, *C. A.* 15, 2260).

W. H. BOYNTON

Principles of alloying to resist corrosion. O. P. WATTS. *Trans. Am. Electrochem. Soc.* 39, Adv. copy (1921).—It is easy to make a corrosion-resisting alloy by melting together two highly resistant or noble metals. The real problem is to take a cheap metal and to add to it a small or moderate amt. of some other element that will render the resulting alloy more resistant. The simple addition of a noble metal to a cheap metal, such as of Pt to Fe, will not suffice, for such a treatment usually increases corrosion. If brittleness is not a drawback, intermetallic compds., especially the silicides, are highly resistant. The protective action of Cu and Ni on Fe and the corrosion-resistance of duriron, monel metal, and of stainless steel are well known. All of these, however, are solid solns. Therefore, W. recommends that to increase the resistance to corrosion of any metal (and to retain some degree of toughness), there should be alloyed with it another metal which is more resistant to corrosion, and which forms a solid soln. with the metal whose resistance to corrosion it is desired to enhance.

CHAS. H. ELDRIDGE

Some observations on the mechanism of increased corrosion resistance of steel and iron due to small copper contents. D. M. BUCK. *Trans. Am. Electrochem. Soc.* 39, Adv. copy (1921); cf. *C. A.* 14, 1289.—The author advances more data to strengthen the sulfur-control and rust-film theory advanced previously by him. As a new test, varying amts. of Cu(0.010% to 0.242%) were added to basic open-hearth ingots during pouring. Next No. 16 gage (XX mm.) sheets were rolled and strips 2' x 4' were exposed to the Pittsburgh weather for periods from 4 to 32 months. After exposure the test pieces were cleaned and weighed, losses being calcd. in oz. per sq. ft. An examn. of results shows that, in general, the rust film on the higher Cu steels is more adherent and thicker than that on those grades containing lower Cu, and also that, as the time element increases, the protective rust film also increases.

CHAS. H. ELDRIDGE

Electrolytic corrosion of lead by continuous and periodic currents. E. R. SHEPARD. *Trans. Am. Electrochem. Soc.* 39, preprint, 23-36(1921).—S. conducted further study

and exptl. work based on the conclusions of McCollum and Ahlborn (*C. A.* 10, 1137) on frequencies in electrolytic corrosion. Their results agreed generally. S. found that with continuous currents, the coeff. of corrosion of Pb: (1) decreases with increased c. d. in both tap H_2O and earth; (2) decreases rapidly with the H_2O content of the earth; (3) decreases with time in tap H_2O , but not in satd. earth. With periodically reversed current, the coeff. of corrosion: (4) decreases rapidly with time to about 14% in satd. earth, and 50% in tap H_2O , if the algebraic sum of currents equals 0; but otherwise (5) increases with the % of total time (*i. e.*, amp.-hrs.) the anodic condition prevails. There are indications of re-deposition of Pb from soil under a. c. electrolysis. Profusely illustrated. F. H. HORCHKISS

An example of rust formation. E. SAUER. *Chem. Ztg.* 45, 421 (1921).—The severe corrosion of wrought-iron condenser tubes through which hot water was flowing was found to be due to the high CO_2 content of the feed-water for the boilers. The removal of the CO_2 from the feed-water by a lime-soda water softener stopped the damage. F. P. FLAGG

Practical aspect of the corrosion problem. JOHN F. THOMPSON. *Trans. Am. Electrochem. Soc.* 39, preprint (1921).—Corrodibility is not a specific property but depends upon the greatest variety of incidental conditions. The use of any particular metal is rarely based upon the sole property of resistance to corrosion. Various other properties, such as hardness, tensile strength, elec. resistivity, etc., are discussed and shown to be very often the detg. factors in the choice of a metal or alloy. C. G. F.

Tarnishing of metals. G. TAMMANN. *Nachr. Kgl. Ges. Wiss. Göttingen, Math.-physik. Klasse* 1919, 225-36; *Z. anorg. allgem. Chem.* 111, 78-89 (1921).—Metal tarnishing develops through the formation of oxide layers of increasing thickness. Some metals show tarnishing in I vapor at ordinary temp.; this was made use of in the detn. of the rate of thickening of the tarnished layer. For Ag the rate of thickening of this AgI layer appears to depend only on the diffusion coeff. for I in the AgI layer. It follows, therefore, that the isotherm should be a parabolic function of the thickness of the region of reaction. The true chem. process takes place more slowly than the diffusion process, for in one case the reagent acting on the metal gave a continuously increasing thickness of the layer of reaction product while in another case the reaction product was found on the surface of the substance in question in a layer of uniform thickness. By placing the metal together with a crystal of I in a desiccator, the action of I vapor in producing surface colors is shown only by Ag, Cu, Pb and Tl. These show layers of the I compd., more or less uniform in thickness and increasing in thickness with the time. Bi and Sb were soon colored yellow with a fine dark dust on their surface. Sn acted similarly. The reaction with Sn seems to produce sub-microscopic crystals which prevent the formation of surface colors. With Fe, Co, Ni, and Mn, very small points of discoloration were observed, which may have been as well due to water vapor as to I. Zn and Cd are very slowly affected. The action on Cr is doubtful. Zn turns slightly blue after many days. The crystals show up on faint etching and treatment with water gives measurable amts. of ZnI_2 . For metals showing surface colors the rate of thickening may be followed by the color change if the I concn. is kept const. Rollet (*L. & B., Tabellen* 1905, p. 610) has correlated earlier work and given a table showing the colors of layers of air of different thicknesses between glass plates. Since the refractive index of AgI is 2.27 the thickness of an air layer of a given color multiplied by 0.4405 gives the thickness of a AgI layer of the same color. Const. I concn. was obtained by satg. air with I vapor at 17° by drawing it through a solu. containing 0.002 g. mol. I and 0.014 g. mol. KI per l. The I-satd. air was passed over a Ag plate contained in a $CaCl_2$ tube. Coloration was not uniform. But the central portion of the plate only was observed. The color was compared with Rollet's table. Data are given for 3 sets

of expts. at 17°. The results are discussed in detail. The thickness of the tarnished layer y , may be expressed as $y^2 = 2pt$, where $2p$ is a const. and t is the time. $2p$ is connected with the rate of diffusion by the expression: $2p = aD(dx/dy)$ where a is a reduction factor for calcg. Agl thickness into quantities of I and dx/dy is the concn. gradient of I. By making 2 detns. with different I concns. two different concn. gradients are obtained and hence D may be calcd. By placing a flat polished steel rod in a metal bath and following the color change at 177°, 191° and 209°, values of the const., $2p$, were obtained which were const. within the limits of exptl. error. The observed color gives the thickness y of the corresponding air layer and this is proportional to βy , the thickness of the tarnished layer. Therefore $y_1^2 = (2p/\beta)t$. At 177° $2p = 1.35 \times 10^{-11}$ and at 204° $2p = 1.67 \times 10^{-11}$. Between 290° and 340° $2p$ changes only very slowly with temp. For hardened steel, $2p$ appears to be independent of the temp. between 325° and 357°, the values for $2p \times 10^{-11}$ being 184, 188, 190 and 194.

E. H. DARBY

The Schoop metal spraying process. P. NICOLARDOT. Ecole Supérieure d'Aéronautique. *Chimie & Industrie* 5, 619-35(1921).—A general review of the improvements in the Schoop process since 1914, and of its more important applications. A. P.-C.

Application of arc welding in machinery construction. A. M. CANDY. *Elec. Rev.* 79, 1-5(1921); 7 illus.—Detailed account. C. G. F.

Soldering fluxes. A. A. LADON. *Chem. Met. Eng.* 24, 981(1921).—ZnCl₂ is the basis of nearly all soft-soldering fluxes. The function of the flux is to decrease the surface tension of molten metals rather than to dissolve the oxide film so that the molten solder can alloy itself to the metal. Rosin is the only non-corrosive flux in a list also including H₃PO₄, tallow, lactic acid and glycerol. W. H. BOYNTON

Phenomena of arc welding. O. H. ESCHHOLZ. *Trans. Am. Electrochem. Soc.* 39, preprint (1921).—A discussion of the mechanism of metal deposition, characteristics of different electrode materials, overhead welding and arc stability. Metal is transferred by vaporization, expulsion of gases, mol. attraction, gravity, and surface tension. About 85% of it is transferred in liquid form through the action of mol. forces. Estd. energy consumption at the negative arc terminal is 60% for liquefaction, 26% for vaporization, and 14% radiation, conduction and convection. An arc welding app. should permit of easy arc establishment for cold electrodes, freedom from "sticking" or "freezing of electrodes on short arc streams, maintenance of a short stable arc and approx. const. current value during growth of the liquid globule, increase of welding current at the instant and during the period in which the globule short circuits the arc stream, and rapid increase in arc voltage at the instant of globule detachment.

W. E. RUDER

"Slip-lines" and twinning in electrodeposited iron (HUGHES) 4. Electrostatic precipitation applied to blast-furnace gases (BUSH) 4. Effect of fluorspar additions on the phosphates in basic slag (BAINBRIDGE) 15. Improvement of low-grade basic slag (JONES) 15. Comparison of the effect of various types of open-hearth basic slags on grassland (ROBERTSON) 15. The diffusion process in solid gold-silver mixed crystals (FRAENKEL, HOUBEN) 2.

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Aetzverfahren und mit Hilfe des Mikroskopes: Berlin: Julius Springer. 124 pp. M 14, bound M 18.40.

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Ore flotation. B. L. GEORGE. U. S. 1,375,957, Apr. 26. An ore pulp is treated with an oil carrying an org. acid, e. g., a creosote oil, and with $ZnSO_4$ and subjected to a flotation sepn. The use of $ZnSO_4$ with the acidified oil serves to facilitate the flotation sepn.

Ore flotation. W. A. SCOTT. U. S. 1,375,233, Apr. 19. In sepg. mineral values by flotation, gas is introduced into an ore pulp, the gas is removed from the bubbles formed before they reach the surface and the mineral carried by the bubbles is sepd. from the remainder of the ore. An app. is described.

Separating constituents of mixed sulfide ores. C. FAUL and H. LAVERS. U. S. 1,375,087, Apr. 19. Mixed sulfide ores containing sulfides of Zn and Pb are subjected to a froth-flotation sepn. in the presence of Cu to obtain a float concentrate relatively rich in sulfide of Zn and a residue relatively rich in other sulfides. Cresol or eucalyptus oil and $K_2Cr_2O_7$ may be used as flotation agents.

Flotation apparatus. W. E. GREENAWALT. U. S. 1,374,447, Apr. 12.

Flotation apparatus for ore separation. W. E. GREENAWALT. U. S. 1,374,499, Apr. 12.

Apparatus for treating ore solutions with hydrogen sulfide or other cases. W. E. GREENAWALT. U. S. 1,374,500, Apr. 12.

Ore grinder and froth flotation apparatus. D. COLE. U. S. 1,375,211, Apr. 19.

Apparatus for concentrating mineral values of ores. W. W. RICHARDSON. U. S. 1,374,472, Apr. 12.

Electrostatic separation method applicable to iron and zinc ores or similar materials. H. M. SUTTON, W. L. STEELE and E. G. STEELE. U. S. 1,375,741, Apr. 26.

Apparatus for treating liquids with gases. W. E. GREENAWALT. U. S. 1,374,445, Apr. 12. The app. is adapted for use in ore flotation. U. S. 1,374,446 relates to a similar app.

Treating ore to exclude air and moisture. C. G. COLLINS. U. S. 1,374,434, Apr. 12. Ores are heated to drive off air and moisture and then treated with crude oil or similar material to prevent reentry of air and moisture. The ore may then be concd.

Pumping and agitating apparatus for treating cyanide solutions and ores. J. F. PIERCE. U. S. 1,376,574, May 3.

Smelting or fusing metallic substances. B. STOUGHTON. U. S. 1,376,479, May 3. In smelting or fusing metallic materials, e. g., in smelting Fe, the material is subjected to the action of heat in a furnace from the combustion of fuel, and the temp. of the furnace product is controlled by means of heated air blast whose temp. can be quickly regulated at will.

Chloridizing ores. J. H. HIRT. U. S. 1,375,002, Apr. 19. Ores, metallurgical products or similar materials to be chloridized are passed downward through a vertical retort and at an intermediate portion of the app. so employed the material is heated to a temp. appropriate to the chloridizing and treated with a chloridizing reagent such as Cl or NaCl in gaseous or vapor form.

Extracting mineral values from highly diluted solutions. M. L. E. BAUDIN. U. S. 1,375,441, Apr. 19. Highly dil. solns. of mineral values such as Au in sea water are brought into contact with an adsorbent formed of a supporting material such as muslin carrying hydrocellulose or similar colloidal adsorbent material and blood charcoal on its surface, in order to effect recovery of values from the soln.

Roasting sulfide ores or concentrates. P. R. MIDDLETON. U. S. 1,376,025, Apr. 26. See Can. 209,380 (C. A. 15, 1130).

Recovering sulfur dioxide from copper mat. W. H. HOWARD. U. S. 1,377,012, May 3. Copper mat is treated so as to drive off gases having a relatively low SO₂ content, and portions of the mat are then removed and successively blown to maintain a continuous flow of gas of relatively high SO₂ content free from solid impurities.

Recovering sulfur dioxide from copper mat. W. H. HOWARD. U. S. 1,377,013, May 3. Different batches of Cu mat are successively treated to remove SO₂ uninterruptedly and to afford a continuous supply of SO₂ in substantially constant amt.

Recovering copper and other metals. G. HAGLUND. U. S. 1,375,631, Apr. 19. Cu and Ni are recovered from mat or similar material in granular form by treating the material with an acid soln. such as H₂SO₄ to dissolve the Cu and the other metal and form a neutral soln. of them. The treatment is continued after the formation of the neutral soln. until the Cu is cemented out by the Ni and a pure soln. of the latter is obtained from which the Ni may be recovered by electrodeposition.

Treating brass scrap. O. C. RALSTON. U. S. 1,375,930, Apr. 26. Brass or a similar Cu alloy is treated with an aq. soln. containing Cl or equivalent solvent for metals electropositive to Cu present in the alloy in order progressively to increase the Cu content of the residue obtained. When the proportion of Cu has attained the desired degree, *e. g.*, about 80%, the operation is arrested and the residue may then be used for melting to form red brass.

Rotary converter for treating molten mat. W. H. HOWARD. U. S. 1,375,965, Apr. 26.

Metallurgical furnace. J. W. GRISWOLD and H. O. LOEBELL. U. S. 1,375,751, Apr. 26. The furnace is adapted for melting brass. It is rotatably mounted for pouring out the charge.

Metallurgical furnace with superposed hearths. D. BAIRD. U. S. 1,375,346, Apr. 19. The furnace is adapted for roasting ores.

Metallurgical furnace adapted for use with oil or gas. F. C. CURTIS. U. S. 1,376,680, May 3.

Smelting furnace operation. J. LABARTHE. U. S. 1,376,947, May 3. Charges of mixed constituents, *e. g.*, Pb or Ag ore, fuel and flux, are dumped at different parts of a smelting furnace so that the quantity of each constituent in the complete charge is the same in any vertical line through the complete charge. Air is forced into the sides of the charge through tuyères near the bottom of the furnace shaft, and gases are vented above the tuyères.

Furnace for melting metals. W. K. BOOTH. U. S. 1,376,071, Apr. 26.

Cutting drains in furnace bottoms with oxygen. J. O. GRIGGS. U. S. 1,376,935, May 3. O is delivered directly to an intensely heated furnace bottom in order to cut drains in it, *e. g.*, for discharging molten metal.

Blast-furnace charging bell, etc. E. L. IVES. U. S. 1,376,430-40, May 3.

Apparatus for feeding material to blast-furnaces. B. NEWTH. U. S. 1,376,438, May 3.

Oscillating puddling-furnace. J. P. ROR. U. S. 1,375,181, Apr. 19.

Producing steel. E. T. PELTON. U. S. 1,376,160, Apr. 26. An acid-lined furnace is charged with ferrous material low in P and S and, after the charge has become molten,

slag is removed from its surface, Fe ore and alloying materials are added, and the charge is withdrawn from the furnace after it has been heated sufficiently to cause ebullition.

Tool steel. P. MACGREGOR and A. BALFOUR. U. S. 1,375,255, Apr. 19. A steel suitable for use instead of ordinary high-speed steels for the manuf. of cutting and milling tools is formed with a content of Ni 1-6, C 1-3.5, Cr 7.5-20 and Mn 0.25-1.0%.

Pickling ferrous metals. J. COULSON. U. S. 1,374,552, Apr. 12. In pickling articles of Fe or steel, they are electrolyzed in a bath containing H_2SO_4 (d. 1.20) first as cathode and then as anode to remove occluded H.

Silver and lead chlorides. AMALGAMATED ZINC (DE BAVAY'S), LTD. Brit. 159,135, Feb. 11, 1921. Ag and Pb are recovered as chlorides from sulfide ores, concentrates, slimes, etc., particularly those containing Pb, Ag and Zn, by treatment with a chloridizing gas at such a temp. that only the Pb and Ag are attacked. The operation is conducted in a closed furnace or retort in the absence of air, and intimate contact between the gas and the solid is ensured by rabbling, passing the gas through layers of the ore, etc., or by allowing the latter to fall through an atm. of the gas. The treatment is preferably carried out between 450 and 600° and the chloridizing gas may be generated *in situ*. In an example, a Broken Hill ore containing Ag, Pb, Zn and Cu is treated with gaseous HCl at 450°. The Ag and Pb are leached out from the treated product either separately or together by solvents in the known manner. Cf. C. A. 14, 2775, 2973.

Drawing metals. R. J. SHOEMAKER. Brit. 158,688, Nov. 10, 1919. See U. S. 1,325,761 (C. A. 14, 398).

Chilled rolls. W. H. NICHOLS. U. S. 1,374,517, Apr. 12. In making chilled rolls adapted for rolling metals, the chilled portion is cooled while the couplings and necks are still highly heated, the roll is removed from the mold and the chilled portion is reheated by the heat permeating it from the couplings and necks.

Hardened cap for projectiles. R. A. HADFIELD. U. S. 1,375,452, Apr. 19. Projectile caps of Ni-Cr steel are heated to a high temp. and then cooled, first rapidly and then more slowly, to about atm. temp., reheated to a temp. somewhat lower than the temp. of the first heating (the temps. may be about 830° and 775°, resp.) and after partly cooling again reheated to about 600° and suddenly cooled. The forward end or nose of the cap is then heated to a high temp. (preferably about 900°) and the cap is cooled by immersion point downward in cooling liquid.

Hardening and tempering cam-shafts. J. F. WANDERSEE. U. S. 1,376,984, May 3. A camshaft is hardened and tempered by placing it between movable electrodes clamped against the shaft so as to hold it, passing an elec. heating current through the electrodes until the cam has attained the desired temp. and then quenching.

Material for carbonizing metals. J. FARRELL. U. S. 1,374,642, Apr. 12. A material adapted for carbonizing metals is formed by removing substantially all moisture from charcoal, coke or similar material *in vacuo* and then impregnating the material with an energizing substance such as Na_2CO_3 or CaO or $BaCO_3$ under 50-100 lbs. pressure and at a temp. of 38-150°.

Casting and hardening metals. H. A. LOMAX. U. S. 1,374,509, Apr. 12. An alloy, e. g., a wire network of hardening metal, is placed in a mold so as to form a part of the casting to be made in the mold, e. g., anvil or roll molds, and molten metal is then introduced into the mold to form the main part of the casting and to fuse with the alloy.

Casting metal tubing. L. CAMMEN. U. S. 1,375,826, Apr. 26. In casting metal tubing a mold is employed which is formed of inner graphite and outer metal portions with an intermediate layer of elec. insulating material and the inner wall of the mold is elec. heated to near the m. p. of the metal to be cast, e. g., monel metal, before the latter is poured into the mold.

Cast-iron ingot-molds. R. G. COATHS. U. S. 1,376,402-3, May 3.

Copper-nickel alloy. F. MILLIKEN. U. S. 1,377,089, May 3. An alloy adapted for resisting hot acids is formed of Cu 45-55, Ni 29-35, Pb 1-3, Zn 5-9, Fe 4-8, and Si 0.30% or less.

Acid-resisting chromium alloy. A. W. CLEMENT. U. S. 1,375,672, Apr. 26. An acid-resisting alloy adapted for making stills, pumps, valves, pipes, etc., is formed of Cr 60, Si 2-4, graphitic C 2-5% and the remainder Fe.

Acid-resisting articles of iron-chromium alloy. A. W. CLEMENT. U. S. 1,375,673, Apr. 26. Articles such as pumps, pipes or cocks for hot dil. H_2SO_4 are formed of an alloy which may consist of Cr 60% and Fe 40% and then heated with a carbonizing material in order to impregnate the superficial portion of the article with C and the surface is quickly cooled to induce the formation of Fe and Cr carbides adjacent to the surface and thereby increase the acid-resisting properties of the article.

Acid-resisting chromium alloy. A. W. CLEMENT. U. S. 1,375,081, Apr. 19. An alloy adapted for resisting H_2SO_4 , HNO_3 and HCl is formed of Cr 40, Mo 4, Fe 55.5 and C 1.5%.

Molybdenum alloy. A. W. CLEMENT. U. S. 1,375,082, Apr. 19. An alloy which is adapted for making acid-resisting articles is formed of Mo 10, Co or Ni 80 and Mn 0.1-4, with or without Fe 10 parts.

Molybdenum alloy. A. W. CLEMENT. U. S. 1,375,083, Apr. 19. An alloy adapted for resisting acids is formed of Mo 10, Ni or Co 80-90 and Fe 10 parts.

Electrical resistance alloy. F. F. HANSEN. U. S. 1,375,454, Apr. 19. An electrical resistance alloy adapted for use in flat irons or the like is formed of Cr 30-60, Cu 30-60 W 2-5 and Mo 1-3%. U. S. 1,375,455 relates to a resistance alloy formed of Cr 93-95, W 2-6 and Al 0.25-1.0%. The alloys m. 1200-1300°.

Ferro-silicon-magnesium alloy. G. PISTOR, A. BRIELSTEIN and A. BECK. U. S. 1,376,113, Apr. 26. An alloy suitable for use as a deoxidizing agent for Fe or cast steel is formed by adding Mg to a ferro-silicon melted to a semifluid state.

Cobalt alloy. J. F. WANDERSEE, R. PERETTO and T. A. L. ALBRECHT. U. S. 1,376,056, Apr. 26. An alloy adapted for the manuf. of cutting tools is formed of Co 35-65, C 2-5, Cr 15-40 and W about 11%. Some Fe also may be present.

Chromium alloy. J. F. WANDERSEE, T. A. L. ALBRECHT and R. PERETTO. U. S. 1,376,062, Apr. 26. An alloy which is adapted for making cutting tools is formed of Cr 20-35%, W 5-20%, Fe 1-15%, Co 40-60% and C 2-5%.

Bearing metal alloy. J. G. KELLY, A. L. PRINGLE and H. HALL. U. S. 1,376,339, Apr. 26. An alloy for manuf. of bearings is formed of Al 1, Zn 1.33, Pb 2 and Sn 4 parts.

Working magnesium alloys. W. R. VRAZEV. U. S. 1,374,968, Apr. 19. Light alloys which contain Mg as the predominant constituent and which may also contain, e. g., 8.5% Al with 91.5% Mg, are heated to 260-370° before forging or similarly working in order to increase tensile strength and remove brittleness.

Gold-nickel-copper alloy. C. D. STOVALL. U. S. 1,375,804, Apr. 26. An alloy adapted for dental use is formed of Au 72, Ni 13.5 and Cu 16.5 parts.

Gold-nickel-copper-platinum alloy. C. D. STOVALL. U. S. 1,376,856, May. An alloy adapted for dental use is formed of Au 72, Ni 13.5, Cu 16.5 and Pt 2 parts.

Electric welding apparatus. G. H. FORSYTH. U. S. 1,375,887, Apr. 26.

Electric welding apparatus. S. THRONSEN. U. S. 1,376,857, May 3.

Arc-welding electrode composition. J. C. ARMOR. U. S. 1,374,711, Apr. 12. Arc-welding electrodes which may consist mainly of Fe or steel are formed with a flux containing Ti, e. g., a rutile mixt., as one constituent of the electrode material, in order to reduce the voltage required in operation.

Silver solder. W. BOCCHETTI. U. S. 1,375,552, Apr. 19. A silver solder is formed of Ag 55-65, Cu 20-30, Zn 10-20 and As_2O_3 about 3%.

Solder and flux for metals. O. F. REINHOLD. U. S. 1,374,233, Apr. 12. A mixt. of NaCl 1, a small amt. of urea and $ZnCl_2$ 4 parts is used as a flux with Al solders.

Tool for testing the hardness of sheet steel or similar materials. F. C. FAIRHOLME, W. H. HATFIELD and G. STANFIELD. U. S. 1,376,413, May 3.

10—ORGANIC CHEMISTRY

CHAS. A. ROUILLER

3,6-Tetramethyldiaminoselenopyronine. M. BATTEGAY and HUGEL. *Bull. soc. chim.* 27, 557-560(1920).—In the action of fuming H_2SO_4 with S in soln. on di- NH_2 derivs. of Ph_2NH , intense colors were found to be due to the presence of Se as impurity in the H_2SO_4 . No color was produced with Se-free acid. This led the authors to replace free S in this reaction by Se compds., and to synthesize 3,6-tetramethyldiaminoselenopyronine from $Ph_2C(NMe_2)_2$. 5 g. of Na_2SeO_3 are dissolved in a few cc. of H_2O , 80 cc. of $H_2SO_4 \cdot H_2O$ added, and the mixt. is shaken to form fine crystals. This is added drop by drop to 150 cc. of $H_2SO_4 + 25\% SO_3$ with shaking at room temp. Simultaneously is added fine dry $Ph_2C(NMe_2)_2$ fast enough to maintain a strong excess, thus increasing the yield. The mixt. should stand 1.5 hrs. At no time should the temp. exceed 35° . The liquor is poured on ice, an intense red forming, and the product then heated to boiling, the red color changing to bluish. The soln. is filtered, and to the filtrate is added $54^\circ B\acute{e}$. $ZnCl_2$ soln. until the surface gives a metallic reflection. In 2 days a cryst. compd. settles, and this is filtered, dissolved in H_2O and reprecipitated by $ZnCl_2$. The mother liquor is blue, owing to $(Me_2NC_6H_4)_2CHOH$. B. and H. obtained 8 g. of $C_{17}H_{19}N_2SeCl_2 \cdot ZnCl_2$. It is sol. in concd. H_2SO_4 with claret color, which on diln. with H_2O becomes blue. $H_2SO_4 + 25\% SO_3$ gives a red-brown soln. with yellow fluorescence. This on diln. with H_2O partly ppt. NaOH forms a reddish blue ppt., sol. in Et_2O with pink color and yellow fluorescence. The latter disappears in time and the soln. becomes yellow, acids making it red. NH_4OH reacts like NaOH, but the Et_2O soln. is yellow. Evapn. in CO_2 gives a yellowish amorphous mass, m. 115° . The colored compds. from iodides and nitrates are slightly sol., from dichromates insol. C. C. DAVIS

Decomposition of hydrocarbons by canal rays. V. KOHLSCHÜTTER and A. FRUMKIN. *Univ. Bern. Ber.* 54B, 587-94(1921).—In earlier papers (*C. A.* 14, 256) the view was developed that black C occurs in graphitic form when it is deposited in a state of mol. subdivision by processes in which the site of reaction assumes chiefly the form of surfaces and its formation is influenced as little as possible by a dispersing medium or adsorption effects, while on the other hand in reactions in space and under the influence of such disturbances the C is obtained in the "amorphous" form. This view involves the assumption that between the two forms of C there is no chem. difference, a result also arrived at by Debye and Scherrer in their work with Röntgen rays. Recently (*Helv. Chim. Acta* 4, 45(1921)) this "topochemical" influence on the process of graphite formation has been further discussed and proved for the formation of C at contact surfaces. Every-day experience has shown, on the other hand, that its sepn. from gaseous compds. in a free space leads to amorphous C. But it is very difficult to study the reaction under such conditions that on the one hand its localization is excluded and that on the other hand C is really condensed, for when the reaction sets in by spontaneous decompn. it usually proceeds chiefly only at contact substances, while thermal dissociation, insofar as it does not occur in flames, likewise usually sets in at surfaces and, like partial combustion, hardly ever yields pure C. As observations on the formation of a pure product in a gaseous medium were of importance in connection with the general conditions of formation of the various types of black C, it occurred

to K. and F. to utilize the energy of canal rays to set C free from gas mols. and so indirectly secure a deposition, occurring free in space, from a mol. state of dispersion, and it seemed to them that a glow discharge through hydrocarbons, especially those with a high content in C, ought to furnish satisfactory exptl. conditions for such an attempt. The first question K. and F. wished to settle was whether C would be deposited in characteristic form and differing in properties with the state of union and the nature of the chains in the hydrocarbons. The full development of their views was hindered by complications to overcome which would have required more elaborate measures than they felt justified in adopting for a problem, the solution of which was so problematical, but they report briefly on some facts which they established; for the present they confine themselves to describing how they prepd. their C. The spherical 100-cc. discharge tube was provided with 4 side tubes placed in pairs, horizontally and vertically to each other. The two horizontal side tubes contained the electrodes. The anode was a thick Al wire ending within the side tube, the cathode a cylinder 1.5 cm. long and 0.5 cm. in diam., closed at one end which extended to within a few mm. of the center of the tube. A new cathode was used for each expt. and was previously weighed on a precision balance. The current, supplied by an induction machine, was on an average 4×10^{-4} amp. In front of the cathode ended a sound introduced through the upper side tube and connected with 2 electrometers to det. the cathode fall in potential. The hydrocarbon vapor was introduced through the lower side tube. The discharge tube was further connected through the anode side arm with a Gaede pump, compression manometer and the necessary drying arrangement. Depending on the nature of the hydrocarbon the side tubes were either kept at room temp. or cooled to about -12° or -80° and the H formed was continuously pumped out so that the pressure never exceeded a few mm. In all the expts. there were deposited, exclusively on the cathode, carbonaceous decompn. products in the form of a coherent gleaming layer; only when the tension became very high as a result of the gradual insulation of the cathode was a very thin film formed on the walls of the tube in the vicinity of the cathode. The deposits on the cathode were at first mostly Cu-colored and transparent, then became brown and finally deep black until they became so thick that the current was no longer transmitted and sparking began (after intervals varying from a few min. up to an hr., depending on the substance used). The cathode, after having been weighed, was placed in a long narrow tube of hard glass connected with a manometer, evacuated and slowly heated to 500° and changes in the deposit on the electrode, the evolution of gases and the formation of sublimates or tars noted. A comparison of the deposits obtained with $C_{10}H_8$, C_6H_6 , Ph, anthracene, phenanthrene, fluorene, decane and petroleum showed that their properties do not depend on the nature of the C unions in the substance decompd. but on the cathode fall in potential at which the decompn. takes place; in other words, on the energy with which the atomic rays act. As long as the cathode fall is in the vicinity of its normal value (200-400 v.) the deposits, even when rather thick (up to about 2 mg.), remain transparent and coherent, give off much gas on heating and yield an abundant distillate of tar; the residual brownish C still covers the electrode in a smooth coherent layer. At a higher cathode fall (500-700 v.) the deposits are much darker and in amts. of about 1 mg. show cracks; on heating they yield less gas and tar but sinter much more markedly. Ppts. obtained with a cathode fall of 700-1500 v. are deep black and tend to peel off; they yield no tar, occasionally a little cryst. sublimate and only very little gas. With still higher cathode falls (2000-5000 v.) almost pure C seps. in loose crumbly layers, hardly yielding any gas, even when heated until the hard glass tube collapses, and not changing in appearance. The magnitude of the cathode fall depends on the vapor pressure of the hydrocarbon and hence on the temp. at which it is heated at the side arm through which it is admitted and on the

rapidity with which its vapor and the gaseous products resulting from its decompn. are pumped out. Consequently the same substance yields different products at different distn. temps. The C deposited in almost pure state at a high cathode fall, as well as that remaining after heating, had the appearance and luster of anthracite but not of graphite or retort C, acted as an insulator on the cathode and gave no graphitic acid with dil. KClO_3 in HNO_3 , dissolving at once with a transient brown color. The products obtained at lower cathode falls resemble coals containing hydrocarbons but how they are formed is an open question; there may be an adsorption of hydrocarbons by the sepd. C or a partial decompn. of hydrocarbon mols. and a combination of the fragments with formation of products richer in C. The C deposited on the cathode undergoes no graphitization under the action of the atomic rays, although this must correspond to extremely high temps. This is a further proof that a definite form of C is primarily produced under specific conditions but cannot afterwards be converted into another form.

CHAS. A. ROULLER

The theory of ammonium salts and the coordination compounds in organic chemistry
 JEAN PICCARD AND JEAN-HENRI DARDEL. *Helvetica Chim. Acta* 4, 406-17(1921).—Whereas the coordination formula of ammonium compds. (and other onium compds.) as proposed by Werner has been generally accepted in the inorg. chemistry, little attention has been given to the formulation as coordination compds. of analogous org. compds. Considering all the elements which form onium compds. the maximal number of radicals, r , which can combine with any of these elements is $r = (8 - n) + 2$, when n represents the number of the vertical row in the periodic system of that element; thus for C, $r = 8 - 4 + 2 = 6$; for N, $r = 5$; for I, $r = 3$. Despite the great advantages of this classification of all onium compds. as belonging to one group, a direct proof for the inferiority of the central formula can only be given in the case of C. This can only have 4 valences as generally accepted; but Kehrman and Effront (*C. A.* 15, 2435) have studied addition compds. of ethylene derivs. with acids, which can only be regarded as having C atoms with 6 valences if written according to the central formula. As one of the radicals is linked by a double bond to the C atom, there is a total of 5 radicals. From the point of view of coordination the constitution of these compds. can easily be explained as carbonium compds. Because the radical with the double bond occupies only one coordination place, these ethylene derivs. are unsatd. from point of view of coordination, and can, therefore, add acid as ammonium does, and form the carbonium compd. A simple carbonium compd. can be made by mixing together liquid C_2H_4 and anhydrous HCl at -100° , the hydrochloride of C_2H_4 being formed (not $\text{HOCH}_2\text{CH}_2\text{Cl}$). Similar compds. seem to be formed in the transition of maleic to fumaric acid by traces of mineral acids and in the transition of oleic to laidic acid. With advantage all chem. compds. can be classified as follows: 1. Compds. unsatd. both from the point of view of valence (regarded as exchange of electrons) and coordination (PhNO , Ph_3C). 2. Compds. unsatd. from the point of view of valence, but satd. from the point of view of coordination (addition compd. of Ph_3C and Et_2O). 3. Compds. satd. from the point of view of valence but unsatd. from the point of view of coordination (AgCl , CaCl_2 , NH_3 , SO_2 ; PhNH_2 , PhNO_2). 4. Compds. satd. from both points of view ($\text{Na}_3[\text{AlF}_6]$, CH_4 , CCl_4). Many physical considerations developed from the modern theory of the atom confirm the preëxistence of places of coordination in the elements which form coordination compds.

E. FIERTZ

Strength of atomic linkages in organic molecules. JOSEPH MARTINEY. *Rev. gén. sci.* 32, 239-43(1921).—Valence is considered to be of two types: (1) valence of coordination, represented by the union of the two C atoms of C_2H_4 and (2) electrolytic valence, typified by that which unites Na and Cl in salt. The first is the result of a magnetic and an electric effect and predominates in org. chemistry, while the second

is of electric origin and is typical in inorg. compds. The elementary reaction types considered are addition, substitution and scission. The stability of linkages is affected by (1) the nature of the atoms and groups in the molecule, (2) triple linkages adjacent, (3) double bonds adjacent, and (4) mobile atoms or groups in an aromatic nucleus. Under (1) M., citing the reactions between metals and, in order, HCl, HOH, NH₃, and CH₄, finds that as the metalloid character of the compd. decreases the H atoms are more firmly bound. The proximity of electronegative atoms renders H atoms mobile and also favors chain ruptures. A double bond is a point of weakness but the splitting at that point is after the addition of electronegative groups. Many mol. rearrangements are explained in the same way, viz. diazoamino to aminoazo compds., phenylhydroxylamines to *p*-aminophenols, hydrazobenzene to benzidine, and Et anilino tartronate to Et dioxindolecarboxylate. The H atom bound to a quadrivalent atom possessing a triple bond shows acid properties, e. g., HCN and HC≡CH. If atom B, singly bound to atom A, possesses also a double bond, then the other single bonds of A are weakened. If H be bound to A it may be replaced by metals when A is electronegative, also by metalloids if A be less electronegative. Examples cited are mineral O acids, org. acids, amides and HN₃. The acidity of CH₃Ac and possible acid properties of cyclopentadiene are attributed to the same influence. When A is less electronegative its H may be replaced by halogens, O and acid groups. The frequent formation of conjugated double bonds is likewise explained and may be predicted. The weakening of a linkage is not confined to those holding H, the loss of a CO₂H group being greatly facilitated by the presence of an influenced linkage; many other scission examples appear in the terpene series. The entering of Br into positions 1 and 4 of CH₂:CMeCH:CH₂ is explained

1 2 3 4

by considering 2 and 3 as B atoms. The formation of osazones is put in the same category. The arrest of this reaction after the second C atom of glucose is said to be due to the fact that the influencing B atom is in the middle of a conjugated double bond chain. M. believes that in substitutions in the benzene ring all groups probably have the same directing or orienting influence on the entering group and that all enter by the *p*- and *o*-positions, remaining there or passing to a *m*-position, depending on the stability of the resulting compd. under the operating conditions, temp., character of the reacting medium, etc. Numerous examples of group migration confirmatory in nature have been found among the sulfonic derivatives. R. L. BROWN

Boron methyl and boron ethyl. ALFRED STOCK and FRIEDRICH ZEIDLER. Kaiser Wilhelm Inst. f. Chemie, Berlin-Dahlem. *Ber.* **54B**, 531-41 (1921). — These substances, so extremely sensitive to air and fats, were handled by the vacuum process (C. A. **14**, 2283), i. e., in a high vacuum, completely protected from air, moisture and fat, and were tested for purity by tension measurements. The ZnMe₂ used, purified by fractionation *in vacuo*, had a tension of 123 mm. at 0°, and the BCl₃, entirely freed from SiCl₄, had a tension of 477 mm. at 0°. About 50 cc. of BCl₃ gas and 100 cc. ZnMe₂ vapor were allowed to react in a 2-l. flask, the process being repeated 5 times and a total of 240 and 500 cc. of the two gases being used. Fractionation of the product in the vacuum of a Volmer pump at a bath temp. of -120° to -115° gave 0.26 cc. ZnMe₂ as a liquid residue and 231.5 cc. of almost pure BMe₃, which after complete purification by further fractionation at -115° at once ignited in contact with air, had a peculiar penetrating odor, attacked the respiratory organs most violently, was very stable at room temp. d. (liquid) at -100° 0.625; its tension, *p*, is given by the equation $\log p = -1393.3/T + 1.75 \log T - 0.007735T + 6.1385$; it m. (in the Al block with propylene filling) -101.5° mol. wt. (from the d. of the gas) at 20-3°, 55.9-57.6. Measurements in a differential manometer, containing H in one arm and BMe₃ in the other, showed that the latter gas corresponds to the simple formula BMe₃ at all temps. between -25° and 100°.

From 575.5 cc. ZnEt_2 (tension, 4 mm. at 0°) and 365.2 cc. BCl_3 , condensed on the inner tube (cooled to -80°) of an app. such as that used in brominating SiH_4 (C. A. 12, 1735), then made to react by slowly heating to room temp., treated in a 500-cc. tube with 0.5 cc. H_2O to decomp. the excess of ZnEt_2 , dried with P_2O_5 , freed from C_2H_6 at a bath temp. of -85° and fractionated, was obtained at -43° to -41° pure BEt_3 , m. -92.9° , b. 95° , d_{20} 0.6931, $\log p = -3502.8/T + 1.75 \log T - 0.01809T + 14.5020$, slowly decomp. on heating; 0.2142 g. heated 24 hrs. at 100° in a 1500-cc. flask gave 1.3 cc. C_2H_4 and after a further 58 hrs. heating 0.4 cc. H_2 and 2.1 cc. C_2H_6 , mol. wt. (gas) 100.5 at 80.0° , 100.3 at 100° (calcd. for BEt_3 98.1). BMe_3 (54.96 cc.) and 55.42 cc. NH_3 (from pure NH_4Cl and CaO and fractionated *in vacuo*) condensed in a 600-cc. flask with liquid air and slowly allowed to rise to room temp. quant. form BMe_3NH_3 ; after removing the excess of NH_3 (0.51 cc. liquid) by distn. at a low temp., the BMe_3NH_3 is obtained in strongly refractive crystals extremely easily volatile *in vacuo*, with tensions of 1.0, 1.8, 2.0, 3.2, 1.10 and 16.5 mm. at 0° , 5.6° , 10.0° , 15.2° , 31.2° and 36.9° , resp., the tension immediately falling back to 1.0 mm. on cooling to 0° , mol. wt. (in vapor form) from 40.25 at 25° to 37.9 at 70° (calcd. for undissociated BMe_3NH_3 73.1), mol. wt. in freezing C_6H_6 70.8; the C_6H_6 soln. was stable to the air, and smelled faintly of BMe_3 , but not of NH_3 .

CHAS. A. ROUILLER

Constitution of the mercury compounds of carbon monoxide and ethylene. II. WILHELM MANCROT. Techn. Hochschule München. Ber. 54B, 571-4 (1921).—Reply to Schöller (C. A. 15, 1310)

CHAS. A. ROUILLER

The manufacture of acetic acid from calcium carbide. MAURICE DESCHENS. *Chimie & industrie* 5, 239-56, 398-408, 518-28 (1921).—Description of the methods and app. used for the manuf. of CaC_2 , of the various C_2H_2 generators used, of the various methods and app. used for the transformation of C_2H_2 into CH_3CHO , and of the methods and app. used for the transformation of CH_3CHO into AcOH , together with a bibliography of articles and of Ger., Brit., U. S., and Fr. patents.

A. P.-C.

The preparation of chloroacetyl chloride. E. DE BARRY BARNETT. *Chem. News*, 122, 220-1 (1921).—After a mixt. of 95 g. of $\text{CH}_2\text{ClCO}_2\text{H}$ and 130 g. of SO_2Cl_2 was heated for 2 hrs. on a water bath the evolution of SO_2 and HCl became slow and the mixt. was boiled until the evolution of gas ceased. The CH_2ClCOCl (b_m $108-10^\circ$) formed was sepd. from the unchanged acid by distn. A 95% yield was obtained.

G. W. STRATTON

Preparation of β -chlorohydrins. L. SMITH. *Scensk. Kem. Tid.* 23, 75-83 (1921).—I. β -Glycerolchlorohydrin (A). Attempts were made by S. to prep. A by the following series of reactions: $\text{HOCH}(\text{CH}_2\text{OH})_2 \rightarrow \text{HOCH}(\text{CH}_2\text{Br})_2 \rightarrow \text{ClCH}(\text{CH}_2\text{Br})_2 \rightarrow \text{ClCH}(\text{CH}_2\text{OAc})_2 \rightarrow \text{ClCH}(\text{CH}_2\text{OH})_2$. The first two reactions ran smoothly but when the $\text{ClCH}(\text{CH}_2\text{Br})_2$ was treated with KOAc at 170° in a sealed tube and the mixt. obtained then hydrolyzed, it was found that the resulting product consisted of 70% α - and 30% β -chlorohydrin. The KOAc had caused the interchange of a Cl and Br atom before the latter was replaced. II. Propylene- β -chlorohydrin (B). S. attempted to prep. B by the action of HNO_3 on $\text{MeCHClCH}_2\text{NH}_2$ (Ber. 50, 804 (1917)), but here also a rearrangement took place during the process, so that a mixt. resulted consisting of only 30% B. A second method for prep. B consisted of the following series of reactions: $\text{MeCH}(\text{OH})\text{CH}_2\text{Cl} \rightarrow \text{MeCH}(\text{OBz})\text{CH}_2\text{OH} \rightarrow \text{MeCH}(\text{OBz})\text{CH}_2\text{Br} \rightarrow \text{MeCH}(\text{OBz})\text{CH}_2\text{N} \rightarrow \text{C}_6\text{H}_5\text{O}_4 \rightarrow \text{MeCHClCH}_2\text{NH}_2\text{HCl} \rightarrow \text{MeCHClCH}_2\text{OH}$, but the product, owing to rearrangements, consisted chiefly of propylene- α -chlorohydrin. A description is given of the method used for detg. the constitution of the products in each case.

R. A.

A method for the degradation of acids of the glutaric acid series. A. WINDAUS AND F. KLANHARDT. Univ. Göttingen Ber. 54B, 581-7 (1921).—In the degradation of certain cholesterol derivs. are obtained hydroaromatic acids of the glutaric acid

series which are very difficult to oxidize and do not undergo a smooth thermal degradation (cf. *C. A.* 13, 1844). For the systematic continuation of the work on cholesterol there was, therefore, needed a method permitting of degrading these acids in a way which could be followed. In searching for such a method it was deemed advisable to study the action of I on the Ag salts of the acids. Of 4 such acids it was found that all react according to the schemes $\text{CH}_2(\text{CH}_2\text{CO}_2\text{Ag})_2 \rightarrow \text{CO}.\text{CH}_2.\text{CH}_2.\text{CH}_2.\text{CO}.\text{O} + \text{O}$ and CH_2-

$(\text{CH}_2\text{CO}_2\text{Ag})_2 \rightarrow \text{CH}_2.\text{CH}_2.\text{CH}_2.\text{CO}.\text{O} + \text{CO}_2$. The yield of lactone depends on the

constitution of the glutaric acid used and on the temp. and ranges up to 40%, the rest of the Ag salt reacting according to the first scheme and the anhydride reforming the Ag salt, which reacts as before, so that by repeating the operation a good yield of lactone is obtained. In the case of $\text{HO}_2\text{CCH}(\text{Et})\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$, where, besides γ -caprolactone, α -ethyl- γ -butyrolactone might theoretically also be formed, only the former was obtained, indicating that in the radical $\text{OCOCH}_2\text{CH}_2\text{CH}(\text{Et})\text{COO}$ the CO_2 is split off much more easily from the tertiary than from the sec. C atom. On this reaction may also be based a method for differentiating acids of the succinic and the glutaric acid series. It has been found that the residue of $\text{HO}_2\text{CCH}_2\text{CHMeCO}_2\text{H}$ decomps. almost exclusively into the anhydride and O and gives no lactone which can be distd., while from all acids of the glutaric acid series with open chains lactones have been obtained in large yields. To det. the position of CO_2H groups in aliphatic di- CO_2H acids, therefore, the acid is evapd. with Ac_2O and heated at $260-80^\circ$; a smooth transformation into a ketone will indicate a pimelic or adipic acid, a smooth transformation into an anhydride stable at this temp. a glutaric or succinic acid; in this case the Ag salt is heated with I, the formation of a lactone indicating the presence of a glutaric acid. The cautiously dried Ag salts of the glutaric acids are finely ground with an equiv. amt. of I, mixed with sand and slowly heated in a long-necked flask. When the reaction sets in, there is a sudden rise in temp. and I vapors are evolved. If enough sand has been used, the reaction proceeds very gradually and is complete after 1 hr. at 150° . The product is exhaustively extd. with Et_2O and the ext. thoroughly shaken with cold coned. K_2CO_3 , freed from any excess of I with a little Na_2SO_3 , dried and distd. In this way glutaric acid gives 30% γ -butyrolactone, b. $202-3^\circ$; from $\text{CMe}_2(\text{CH}_2\text{CO}_2\text{H})_2$ was obtained, besides 35% of the acid recovered from the alk. soln., 40% of β,β -dimethyl- γ -butyrolactone, cryst. mass, m. $55-7^\circ$, b. $207-8^\circ$, volatile with steam. α -Ethylglutaric acid yields γ -caprolactone, b. $215-6^\circ$, identified by conversion into the Ba salt of the HO acid, which is easily sol. in abs. alc., and by its oxidation to $(\text{CH}_2\text{CO}_2\text{H})_2$. $\text{CH}_2(\text{CH}(\text{Et})\text{CO}_2\text{H})_2$ gives α -ethyl- γ -caprolactone, b. $231-3^\circ$.

CHAS. A. ROUILLER

The formation of lactic acid from sugars. A. VALEUR. *Bull. sci. pharmacol.* 28, 252-8(1921).—An attempt to give a theoretical explanation of the formation of *dl*-lactic acid on the breaking up of various sugars, and why there can be no rigid relation between the structure of the lactic acid obtained and the optical rotation of the sugar from which it is derived

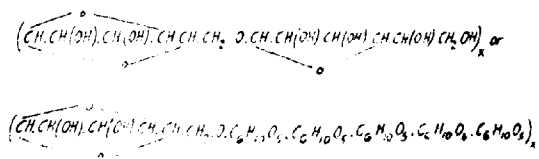
F. S. HAMMETT

Preparation of galactose. E. P. CLARK. U. S. Bur. Standards. *J. Biol. Chem.* 47, 1-2(1921).—Dissolve 1500 g. lactose in a mixt. of 3750 cc. H_2O and 75 g. coned. H_2SO_4 . Bring to a boil and simmer for 2 hrs. Add a thin paste of BaCO_3 until the liquid is neutral to Congo paper. Allow to settle overnight and draw off the supernatant liquid. Filter this through a layer of active C on a paper in a Buchner funnel and then transfer the ppt. to the filter. Drain thoroughly and wash with a little H_2O . Concentrate under diminished pressure to a wt. of 1650 g. ($n_D^{20} = 1.5120$ to 1.5125). Warm to $60-70^\circ$, add 250 cc. EtOH and mix thoroughly. Rinse into a beaker with 500 cc. MeOH , seed with galactose, and allow to cryst. for 4 days. Filter, wash with MeOH , 85% EtOH and

finally with 95% EtOH. Yield, 27% of lactose taken. To purify, dissolve in 3 parts H₂O, add a few cc. HOAc, and concentrate under diminished pressure to 75% solids, warm to 60–70°, transfer to a beaker and add 95% EtOH to satn. Let stand overnight, filter, wash and dry. Yield, 82–83% of crude sugar. I. GREENWALD

Polysaccharides. III. Cellulose. P. KARRER AND FR. WIDMER. Univ. Zurich. *Helvetica Chim. Acta* 4, 174–84 (1921).—5 g. each of cellulose (A), cellobiose (B), methylcelloside (C), acetylcellulose (D), acetylcellobiose (E), and acetylmethylcelloside (F) were heated to 105° with 20 cc. Ac₂O and 2.66 cc. concd. H₂SO₄, kept at this temp. 0.5 min., and quickly poured into H₂O; the amt of recrystd. (E) found in each case was: for A, 14% of the theory, for B 15.3%, C 28%, E 31%. It thus appears that in this reaction, which has often been used as a basis for deductions as to the structure of A, about 70% of the E is lost, so that this much must also disappear in the acetolysis of A itself. Therefore the 14% E found in the case of A only represents about 30% of the B complex in A, which must therefore contain at least 50% B complexes. This value is probably minimal, since under the conditions used the hydrolysis was not complete and dextrans were formed, but no data are at hand to indicate that A consists of 100% B complexes. It thus appears that Hess' formula for A (C. A. 15, 1619) allowing for only 33% B is not valid. Held 1 min. at 105° under otherwise the same conditions D is more stable, yielding only 8.6% of the theory of E and much dextrin; at 110° for 1 min. the max. yield of 10.3% was obtained; at 120° hydrolysis was complete but only 7% E was formed. Under these conditions A yielded 8%, and in the case of E itself all but 18% was destroyed. These figures also point to a content of 50% B in A. Attempts were made to det. the structure of B through methylation and subsequent hydrolysis, but in weakly alk. solns. methylation was incomplete, while in strong alkali partial hydrolysis and decompn. occurred. Good yields were, however, obtained from C. 50 g. F were shaken at room temp. with 180 g. cryst. Ba(OH)₂ and 3 l. H₂O until dissolved, let stand 12 hrs., and the Ba⁺⁺ pptd. with just enough H₂SO₄. The filtrate was concd. to 300 cc. at 50° in *vacuo*, treated with stirring with 100 cc. 30% NaOH and 37 cc. Me₂SO₄, gradually heated to boiling, cooled, and the process repeated 8 times. After filtering off the Na₂SO₄ and extg. with CHCl₃ the ext. was dried with CaCl₂ and concd., 30 g. oil b₁ 223–4° being obtained. The crystals which sepd. on cooling were sucked off and recrystd. 3 times from Et₂O, yielding *hexamethylmethylcelloside* (G), m. 83–4°, [α]_D²⁰ in H₂O, –7.73°. The oily fraction probably contains isomers, as it also goes over completely into H (below). 17 g. G, crude or purified, boiled 2 days with 100 g. MeI and 40 g. Ag₂O, filtered, the residue extd. with CHCl₃, and the MeI and CHCl₃ distd. off, gave *heptamethyl-β-methylcelloside*, needles from Et₂O, m. 88°, [α]_D²⁰ –15.91° in H₂O; boiled 2 hrs. with 5% aq. HCl it yielded, after fractional distn. in a high vacuum and subsequent fractionation of the portion b_{0.3} 110–25° from ligroin, tetramethylglucose, needles from Et₂O, m. 94°, not 89°, initial [α]_D 101°, final 83°. The fractions representing trimethylglucose could not be made to cryst. **IV. Structure of potato starch.** P. KARRER AND C. NAGELI. *Ibid* 4, 185–202 (1921).—10 g. potato starch (A) (purified according to Malistano) were dissolved in 300 g. H₂O in an autoclave at 130° and the filtered soln. stirred at 43–5° with 28 g. MeI and 64 g. Ag₂O, raising the temp. to 65° for 15 min. after most of the MeI is used up, cooling again to 40°, repeating the process twice, and finally heating 2 hrs. at 65°. After filtering and extg. the ppt. with 150 cc. H₂O at the b. p., concg. to the original vol., repeating the whole methylation process, boneblackening, and concg. to dryness in *vacuo* the residue was pulverized, washed with alc. and Et₂O, and dried at 100° in *vacuo* over P₂O₅; 5 g. were obtained. The ash content was 4.1%, MeO 17.8% (calcd. for (C₆H₇O₄OMe)_x 17.6%), mol. wt. in PhOH, 1259, in H₂O, 508, the low value possibly being due to the ash, gives a violet-red color with I. A parallel expt. in which A was heated with H₂O and Ag₂O alone at 100°

showed no hydrolytic action. A more highly methylated product was obtained with Me_2SO_4 and $\text{Ba}(\text{OH})_2$ (cf. Pringsheim, *C. A.* 9, 2544) or NaOH . 10 g. A were shaken on the H_2O bath with 800 cc. H_2O until free from lumps, treated with stirring with 330 g. crystd. $\text{Ba}(\text{OH})_2$ in 800 cc. H_2O , heated to boiling, and then 126 g. Me_2SO_4 allowed to drip in, with stirring. After 1 hr.'s boiling the treatment with $\text{Ba}(\text{OH})_2$ and Me_2SO_4 was repeated and the mixt. then boiled and stirred 1 day to convert as much $\text{BaMe}_2(\text{SO}_4)_2$ as possible into BaSO_4 , replacing the evapd. H_2O from time to time and making sure that the reaction remained alk. The BaSO_4 was filtered off, rubbed to a paste with 800 cc. H_2O , and this neutralized exactly in order to destroy the excess of $\text{Ba}(\text{OH})_2$ and free any A held by this. After filtering again and washing with hot H_2O the combined filtrates were again methylated as before, finally boiling for 2-3 days, filtering, neutralizing exactly with H_2SO_4 , filtering again, concg. to dryness at $30-40^\circ$, and extg. twice with 100 cc. CHCl_3 . The ext. was dried, concd. dry *in vacuo*, and the residue pulverized and dried at 100° *in vacuo*. The yield was 4.5 g.; the product contained but 0.4% ash and the MeO content agreed with $\text{C}_6\text{H}_9\text{O}_5(\text{OMe})_x$, gave a red-brown color with excess of I soln., mol. wt. of different preps. in H_2O , 988-1026; in CHBr_3 1689; aq. solns showed the Tyndall phenomenon and colloid particles under the ultramicroscope, but could be filtered through a De Haen membrane filter (pores 20μ), only a small portion remaining on the filter. The filtrate no longer contained colloidal particles and could be dried *in vacuo* and redissolved in H_2O to form optically empty solns., but if such an aq. or CHBr_3 soln. is frozen or warmed it again becomes turbid. $[\alpha]_D$ varied from 190° to 202° in H_2O , and the filtered and unfiltered preps. showed essentially the same const., indicating that the colloidal particles were methylated to the same extent. Diastase, ptyalin, and *B. macerans* did not break down the compd., nor did migration to either electrode take place at 60 volts. Boiling with MeI and Ag_2O raised the MeO content only slightly. Control expts. showed that boiling A 2 days with $\text{Ba}(\text{OH})_2$ soln. had no hydrolytic effect. When 10 g. A was dissolved in 250 cc. H_2O at 130° and methylated with 45 g. NaOH in 50 cc. H_2O and 63 g. Me_2SO_4 , and the process repeated, the methylstarch so obtained was similar to that formed by the $\text{Ba}(\text{OH})_2$ process, but had the max. MeO content, 35.5%, mol. wt. in H_2O , 1830, sol. in cold H_2O , but seps. partially on boiling, redissolving on cooling, thus showing somewhat more pronounced colloidal properties, which were also confirmed by ultrafiltration expts. It is believed that the above results are best explained by assuming as an intermediate stage between the starch crystal and the ultimate "starch molecule" a so-called "associated starch," and that A itself is built up from the ultimate "starch molecules" by a process of association. The ready tendency of the ultrafiltered solns. again to form colloidal particles, especially in CHCl_3 and CHBr_3 , which favor polymerization of HO-containing substances, the differing mol. wts. of the different preps., and the analogous results obtained by Schardinger in the degradation of A by *B. macerans*, are all believed to point in the same direction. It is believed that A contains not more than 6 glucose mols. combined by primary valencies, and that it may be represented by some such formula as



(cf. Pringsheim and Eissler, *C. A.* 8, 118). The general thought is expressed that A and other similar polysaccharides are polymers of anhydrosugars which are composed of

only a few monosaccharides. The non-reducing dextrans would thus be polysaccharides whose degree of dissociation is less than that of the starting material, but in which the primary valencies of the source are still intact, dissolution of these being evidenced by appearance of reducing power. Certain objections of Hess (*C. A.* 15, 751) are answered.

V. **Methylation of inulin.** P. KARRER AND LINA LANG. *Ibid* 249-50.—Results differing somewhat from those of Irvine and Steele (*C. A.* 15, 1017) were obtained. After inulin (A) was found to be unaffected by heating with KOH of the concn. used, 10 g. in a little H₂O were treated in the course of 2 days with 9 portions of 28 g. KOH in 30% soln. and 25 g. Me₂SO₄, stirring, and keeping at 70°, letting the temp. drop to 30° only when adding a portion of Me₂SO₄. The methylinulin (B) which seps. during the reaction is redissolved in H₂O and again added to the mixt., sepg. very finely divided. After shaking out with CHCl₃ the ext. is dried and concd. *in vacuo*, taken up in Et₂O, filtered, and the ext. again evapd., leaving the B as a colorless, amorphous, pulverizable mass containing 0.1% ash, 39.2% MeO (corresponding to 2.5 MeO to each C₆H₁₀O₅ complex), $[\alpha]_D -43.2^\circ$ in H₂O. After filtration through an ultrafilter, and concn. to dryness *in vacuo*, during which process it again became turbid, B showed a MeO content of 39.4%, $[\alpha] -41.2^\circ$, and a mol. wt. of 1711. 3 g. B heated with 100 g. MeI and 75 g. Ag₂O for 8 days gave a *trimethylinulin* which was not *d*-rotatory nor oily like I. and S.'s product, but *m.* 102-7° and shows $[\alpha]_D -42.7^\circ$ in CHCl₃, mol. wt. in PhOH, 1892, less sol. in H₂O than B. The structure of A is explained on the same basis as that of starch, the ultimate mol. being possibly an anhydrofructose. It is not believed possible that more than 8-10 fructose mols. can be in combination by primary valencies on the basis of the above mol. wt. detns. M. HEDELBERGER

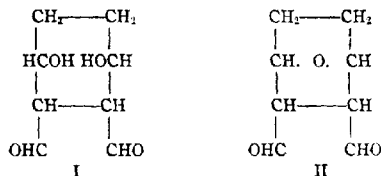
Glucosides. IX. P. KARRER *et al.* *Helvetica Chim. Acta* 4, 130-48(1921).—K. has shown (*C. A.* 13, 1841; 14, 742, 1972) that BrC₆H₄O₃Ac₄ (A) reacts with the Ag salts of *o*- or *p*-HO and *o*-NH₂ acids to form both acetylated glucosides and glucose esters, indicating that the Ag is bound to both the CO₂H and the OH or NH₂ groups by principal and secondary valencies. On this assumption, *m*- and *p*-HOC₆H₄CO₂Ag should yield tetraacetylglucose esters but no glucoside, since the more distant OH groups would exercise no appreciable effect on the Ag atom. By boiling 25 g. of *p*-HOC₆H₄CO₂Ag with 41 g. of A in 200 cc. of C₂H₅ for 1.5 mins. and filtering while hot *tetraacetylglucose p-hydroxybenzoate* crystd. from the filtrate on cooling, *m.* 197°, $[\alpha]_D^{20} -29.76^\circ$. On extg. the filtrate with dil. NH₃ and acidifying, a white cryst. ppt. was formed, identical with the above compd. No glucoside was found. Similarly, *tetraacetylglucose m-hydroxybenzoate* was prepd., white needles from EtOH, *m.* 147°, $[\alpha]_D^{20} -26.61^\circ$. The combination between Ag and S in HSCH₂CO₂Ag was apparently too firm, as no reaction with A took place. Instead of using the Ag salt, 17 g. of A in 25 cc. of abs. MeOH were mixed with 2 g. of K in 25 cc. of MeOH, to which 7 g. of HSCH₂CO₂Et had been added. KBr was pptd. and removed after 2 hrs. and the filtrate evapd. *in vacuo* at 30-40° to remove MeOH. The resinous residue was digested with Ac₂O and AcONa to restore any Ac group split off, treated with cold H₂O to destroy Ac₂O, dissolved in Et₂O, the soln. evapd., and the crude product extd. with hot H₂O. On cooling, long needles of *ethyl β-tetraacetyl-δ-glucosidoethioglycolate* formed, sol. in EtOH, Et₂O, C₆H₆, *m.* 63°, $[\alpha]_D^{25} -58.52^\circ$. Sadt. Ba(OH)₂ converted it into *β-δ-glucosidoethioglycolic acid*, *m.* 148-50°, $[\alpha]_D -66.19^\circ$. From 20 g. of 2,5-HO(MeO)C₆H₃CO₂Ag and 30 g. of A in 250 cc. of boiling C₂H₅, AgBr was pptd. and removed, and the C₂H₅ soln. extd. repeatedly with 50-cc. portions of 1:40 NH₃. The latter was acidified with HCl, after filtering, giving a white cryst. ppt. of *β-tetraacetyl-δ-glucosido-5-methoxygentisinic acid* (B), needles from EtOH, *m.* 172-4°, $[\alpha]_D^{20} -32.13^\circ$. From the C₂H₅ after the NH₃ extns. *tetraacetylglucose 5-methoxygentisininate* crystd. on evapn., needles from EtOH, *m.* 163°, $[\alpha]_D^{20} -40.2^\circ$. Cold sadt. Ba(OH)₂ saponid. B to *β-δ-glucosido-5-methoxygentisinic acid* (C), fine needles from EtOH, *m.*

166°, $[\alpha]_D^{20} -39.62^\circ$, easily sol. in H_2O , insol. in Et_2O . *Methyl ester of C*, by the action of CH_3N_3 in Et_2O on *C* in concd. $EtOH$ soln., m. 83° , $[\alpha]_D^{20} -48.52^\circ$. The above method applied to 13 g. of Ag *p*-methylmandelate and 25 g. of *A* in 125 g. of C_7H_8 gave 16 g. of *dl*-tetraacetylglucose *p*-methylmandelate, snow-white needles, m. 155° , while the NH_3 extns. yielded 5 g. of β -*d*-tetraacetylglucosido-*p*-methylmandelic acid, small felt-like needles, m. $149-50^\circ$. By the action of KCN and concd. HCl on 50 g. of *o*- ClC_6H_4CHO at 0° , 55 g. of *o*-chlorobenzaldehyde cyanohydrin were obtained, and converted into *o*-chloromandelic acid by sapon. with concd. HCl . Unchanged aldehyde was sepd. by extg. the crude product with 10% $NaOH$, acidifying and crystg. the acid from C_6H_6 , the yield being 18 g., m. $84-5^\circ$. The acid was dissolved in $EtOH$, treated with the equiv. amt. of $AgNO_3$ in H_2O , and NH_4OH added from a buret, giving silver *o*-chloromandelate. From 15.6 g. of the latter, rubbed in a mortar with *A* and heated with 100 cc. of C_7H_8 , $AgBr$ was pptd. and removed, and the C_7H_8 soln. extd. with 0.5% NH_4OH as above, etc., giving β -*d*-tetraacetylglucosido-*o*-chloromandelic acid, small white needles from dil. $EtOH$, m. 182° . Similarly, 8 g. of Ag orsellinate with the equiv. amt. of *A* gave tetraacetylglucose orsellinate, m. 153° , $[\alpha]_D^{19} -41.75^\circ$. Ag quinolcarboxylate (Ag gentisinate) and *A* yielded tetraacetylglucose quinolcarboxylate, white needles from $EtOH$, m. 185° , $[\alpha]_D^{18} -39.82^\circ$. Five g. of Ag mandelate and 13.5 g. of acetobromomaltose in 100 cc. of boiling C_7H_8 gave a small yield of heptaacetylmaltosido-*dl*-mandelic acid, which could not be obtained cryst., m. $65-85^\circ$, insol. in H_2O , easily sol. in $EtOH$. Polarization in $CHCl_3$ gave varying results, $[\alpha]_D$ $9-35^\circ$. This compd. agrees rather closely with acetylamygdalic acid in m. p. and $[\alpha]_D$, but is entirely different from acetylcellosidomandelic acid, which is cryst., m., $179-82^\circ$, $[\alpha]_D -44^\circ$. These facts furnish additional evidence that the sugar of amygdalin is not a cellobiose, but is probably maltose or isomaltose. A study of the influence of various salts, etc., on the rotation of glucosides showed that in 2% soln. salicin was affected by H_3BO_3 , $Na_2B_4O_7$ and $NaOH$, but not by $NaCl$, KCl , KHC_2O_4 , KNO_3 , $CaCl_2$, or $H_2C_2O_4$. Amygdalin was affected by $Na_2B_4O_7$, which caused mutarotation, and by $NaOH$. Menthyl α -glucoside was not affected by any of the above in 0.5% $EtOH$ soln. or in 0.5% glycerol soln.

M. R. SCHMIDT

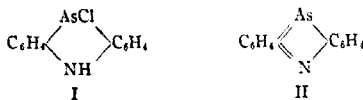
Synthesis of humins and humic acids. J. MARCUSSEON. *Ber.* **54B**, 542-5(1921); cf. Eller and Koch, *C. A.* **15**, 83.—E. and K., who report the synthesis of humic acids by the oxidation of phenols with atm. O or $K_2S_2O_8$ in alk. soln., apparently overlooked M.'s syntheses starting from furan aldehydes (*C. A.* **13**, 2751) and from pyromucic acid (*Chem. Ztg.* **44**, 44(1920)). The product obtained from the latter by heating in a sealed tube with HCl at 130° contains 75.1% C , 5.0% H , 1.4% Cl and 18.5% O , which represents a considerable increase in C and decrease in O as compared with pyromucic acid and cannot be due merely to anhydride or ketone formation. To obtain more lucid results further expts. were carried out with furan, the mother substance of pyromucic acid. The product obtained from furan with concd. HCl was light brown, infusible, converted by fused KOH into humic acid and contained 65.5% C , 5.2% H , 0.7% Cl and 28.6% O ; the Cl could not be removed by boiling with H_2O or alc. or by treatment with alkalis or NH_4OH . As furan contains 70.6% C , 5.9% H and 23.5% O it is evident that the ring had been ruptured. By the addition of 1 mol. H_2O furan is converted into $(CH_2CHOH)_2$; this is unstable under the conditions of the expt. and rearranges into $(CH_2CHOH)_2$, which is polymerized (resinified), with loss of H_2O , by the HCl . Two mols. of the aldehyde, by the loss of 1 mol. H_2O , would yield a substance with 62.3% C , 6.5% H and 31.2% O , which is approx. the compn. of the resin obtained from furan with HCl . As far as can be judged from the data at hand, 2 mols. of the aldehyde undergo an aldol condensation to *I* which, by loss of 1 mol. H_2O , forms a *peri*-difuran (*II*) and this, as the result of the presence of the two aldehyde groups, simultaneously polymerizes, the polymer being the simplest representative of the humins. If furfural is taken in-

stead of furan as the starting material, 2 mols. of H_2O are taken up under the influence of the HCl , the CHO group being split off as HCO_2H and the ring being ruptured and again forming $(\text{CH}_2\text{CHO})_2$. The formation of natural humins may be considered as being brought about by the cellulose being hydrolyzed to levulose, which then gives levulinic acid and hydroxymethylfurfural. As pointed out by E. and K. there exists a whole series of different humic acids: to det. whether those obtained from phenols are identical with the natural acids will require further study. Unlike most aromatic compds., the natural humic acids yield neither SO_3H acids with H_2SO_4 nor NO_2 derivs. with HNO_3 ; H_2SO_4 , both hot and cold, gives H_2O -insol. addition products very stable towards NaOH and giving H_2SO_4 when heated with H_2O or HCl , and the products (containing 4–5% N) obtained with HNO_3 cannot be reduced and on heating with HCl under pressure lose part of their N. On the basis of their synthesis from phenols, E. and K. conclude that the acid properties of the humic acids are to be ascribed to phenolic HO groups, but M. has found that the natural acids are easily, although not quant., esterified by 3% alc. HCl and that on cautious heating at 250° , e. g., in the presence of superheated steam, they split off, together with H_2O , considerable CO_2 and become insol. in NH_4OH , indicating the presence of CO_2H groups. The humic acids form the link between cellulose and lignite, the residue obtained by heating the acids at 250° having in general the same properties as the chief constituent of lignite.



CHAS. A. ROUILLER

Cyclic arsenic compounds of the aromatic series. HEINRICH WIELAND and WILHELM RHEINHEIMER. Berlin and Munich. *Ann.* 423, 1–38 (1921).—*Phenarsazine chloride* (I) (Ger. pat. 281,949), prepd. by heating 181 g. AsCl_3 and 169 g. Ph_2NH on the sand bath for 4 hrs. or till the temp. reaches 210° and then adding 1 l. boiling $\text{C}_6\text{H}_5\text{Me}_2$, yellow needles from $\text{C}_6\text{H}_5\text{Me}_2$ or AcOH , m. 193° . The green color of the crude product is due to an impurity. It sublimes in vacuum. Conc'd. H_2SO_4 gives a dark red soln., from which H_2O ppts. the orange yellow sulfate.



Phenarsazine oxide (A), $\text{C}_{12}\text{H}_{10}\text{ON}_2\text{As}_2$, obtained by the action of aq. alkali upon an Me_3CO soln. of I, leaflets from PhNO_2 or $\text{C}_6\text{H}_5\text{N}$, m. above 350° . *Phenylarsazine methyl ether* (B), $\text{C}_{12}\text{H}_{10}\text{ONAs}$, from I by the action of an excess of MeONa , long needles from MeOH , m. 194° . Boiling with alkali or H_2O gives A, which, boiled with MeOH , again gives B. *Acetate* (C), by dissolving A, or B in AcOH , greenish, shimmering leaflets, m. $223\text{--}4^\circ$. *Phenarsazine sulfide*, $\text{C}_{12}\text{H}_{10}\text{N}_2\text{As}_2\text{S}$, by satg. a boiling MeOH soln. of A or B with H_2S , fine yellowish needles or leaflets from $\text{C}_6\text{H}_5\text{Me}_2\text{CO}$, m. 262° . Boiling with high-boiling solvents causes the evolution of H_2S and the formation of II. When A is boiled with carefully dried $\text{C}_6\text{H}_5\text{N}$, Me_3NPh , or $\text{C}_6\text{H}_{11}\text{N}$, an orange-yellow compd. is formed, which analyzes for *triphenylarsazine chloride*, $\text{NH}(\text{C}_6\text{H}_5)_3\text{AsN}(\text{C}_6\text{H}_5)_3\text{AsN}$.

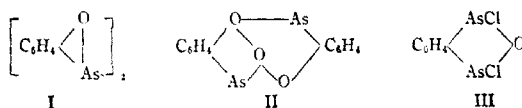
(C_6H_5)₃AsCl, m. 280-3°. With C_6H_5N containing some H_2O , this yields A. If NH_3 is passed into a soln. of I in dry C_6H_5Me , *triphenylarsazine amine*, $[HN(C_6H_5)_3As]_2N$, results, m. 295-300° (decompn.), and gives C with boiling AcOH. When this is boiled in indifferent solvents or, better, heated in a vacuum at 200-300° *phenarsazine* (II) is formed; this is not pure and II is best prepd. by heating B in MeNPh₃. After the MeOH has distd. off, dry CO_2 is passed into the soln. and the boiling continued for 1 hr. The product is carefully washed with dry $Ph_2NMe-C_6H_5$, then with C_6H_6 and finally with Et_2O and dried in CO_2 . It forms orange-red prisms, m. about 310°. The yellow soln. is decolorized by shaking with air, forming A. With MeOH this yields B, with AcOH C. Concd. H_2SO_4 gives the orange-yellow sulfate. Attempts to reduce I with Zn and AcOH gave a yellow compd., sensitive to air, which is probably dihydrophenarsazine. *N-Methylphenarsazine chloride*, $MeN(C_6H_5)_3AsCl$, is obtained in a small yield by heating Ph_2NMe with $AsCl_3$, yellowish green needles from MeOH-CHCl₃, m. 203°. The concd. H_2SO_4 soln. does not have a characteristic color. *p,p'-Dinitrophenarsazine chloride*, $C_{12}H_8O_4N_2ClAs$, prepd. by dissolving 10 g. I in 120 cc. AcOH, cooling the soln. to 20°, and dropping in 4.5 cc. fuming HNO_3 (temp. carefully controlled), and removing the mono- NO_2 derivs. by digestion with cold Me_2CO , pale yellow needles, m. above 300°. The alc. suspension, treated with a few drops of NaOH, is colored reddish violet because of the formation of the quinoid *aci-nitro* salt. *o-Nitrophenarsazine chloride* (D), $C_{12}H_8O_4N_2AsCl$, obtained by evap. the Me_2CO soln. and extg. with C_6H_6 in which the *p*-deriv. is practically insol., and then with Et_2O and finally crystg. from C_6H_6 or AcOH, scarlet-red needles, m. 156°. The *p*-derivative (E), dark, greenish yellow leaflets from AcOH. *Phenarsazinic acid* (F), $HN(C_6H_5)_3AsO_2H$, prepd. by suspending I in AcOH, adding a small excess of 30% H_2O_2 , and warming, felt-like needles with 1 AcOH, m. above 300°. *Sodium salt*, needles from NaOH. Upon nitration in AcOH (temp. not over 28°) a mixt. of the *o*- and *p*-derivs. results. *o-Nitrophenarsazinic acid* (G), $C_{12}H_8O_4N_2As$, purified by extg. the mixed Na salt with 50% AcOH, pale yellow needles with 1 H_2O from dil. AcOH, or with 1 AcOH from glacial AcOH. *Sodium salt*, brownish yellow needles from H_2O . The *p*-derivative is formed in only small amts., and is best obtained by oxidation of E with H_2O_2 in AcOH; the Na salt is brick-red in soln., from which further alkali ppts. the quinoid *aci-nitro* salt in glistening bronze needles. G was also prepd. by the oxidation of D. When I or F is added to warm concd. HNO_3 (d. 1.14) and the soln. raised nearly to the b. p., *p,p'-dinitrophenarsazinic acid* is formed, also by oxidizing the chloride with H_2O_2 , pale yellow needles from AcOH. The quinoid Na salt crystals in glistening bronze leaflets; the mono-Na salt forms fine yellow needles, and may be prepd. by dissolving the acid in Na_2CO_3 or by the action of CO_2 on the *aci*-salt. G, reduced by $Fe(OH)_2$ [10 g. acid in 200 cc. N NaOH, added to the $Fe(OH)_2$ from 50 g. $FeCl_3$ and 150 cc. 5 N NaOH] gives *o-aminophenarsazinic acid*, $C_{12}H_{11}O_4N_2As$, isolated by neutralizing the filtrate with HCl and adding AcONa, needles with 1 EtOH from alc. *Hydrochloride*, needles. *p-Aminophenarsazinic acid*, $C_{12}H_{11}O_4N_2As$; the alk. soln. becomes violet on exposure to air. $FeCl_3$ gives a brick-red soln., which deposits an amorphous red dye; CrO_3 gives a blue color and then a greenish black ppt. *Sodium salt*, glistening brown lamellas. *Chloride*, best prepd. by the reduction of the *p*-acid with SO_2 in concd. HCl containing a little KI, isolated as the *hydrochloride*, $C_{12}H_{11}N_2ClAs$, yellowish green, which gives a colorless soln. in H_2O (salt of the aminophenarsazine oxide); excess of concd. HCl changes this to the chloride. The HCl salt is a very good throat irritant. *p,p'-Diaminophenarsazinic acid*, isolated as the *dihydrochloride*, $C_{12}H_{11}O_4N_4As \cdot 2HCl$, leaflets. This is characterized by the intense color obtained when Ag_2O is added to the alk. soln. $FeCl_3$ produces a deep blue followed by a violet color, and then a dark red oxidation product. *m-Aminodiphenylamine*, $C_{12}H_{11}N_3$, prepd. by the reduction of 35 g. $m-O_2NC_6H_4NHC_6H_5$ in 100 cc. hot alc. with 300 cc. concd. HCl and 100 g.

Sn, long leaflets grouped into stars from hot H_2O , m. $76-7^\circ$. 5 g., heated with 8 g. AsCl_3 at $140-70^\circ$ for 5 hrs., gave *m*-aminophenarsazine chloride, isolated as the *hydrochloride*, $\text{C}_{12}\text{H}_{10}\text{N}_2\text{AsCl}\cdot\text{HCl}$, yellowish green leaflets. Na_2CO_3 gives the oxide. Ag_2O does not attack the $\text{C}_6\text{H}_5\text{N}$ soln. Oxidized with H_2O_2 in 0.1 *N* NaOH , *m*-aminophenarsazinic acid is formed, rhombic prisms; *hydrochloride*, prisms. *Arsanthrenic acid* (*biphenylene-o-diarsinic acid*) $\text{HO}_2\text{As}(\text{C}_6\text{H}_4)_2\text{AsO}_2\text{H}$, is formed by oxidizing the dichloride (see Kalb, following abstr.) with 10 parts warm HNO_3 (d. 1.38) until the evolution of NO_2 gases ceases. It forms long prisms, m. above 360° . It is very resistant to substitution. *Nitrodiphenylarsinic-o-arsinic acid*, $\text{C}_{12}\text{H}_{11}\text{O}_7\text{NAs}_2$, by the action of 200 cc. fuming HNO_3 , 150 cc. concd. H_2SO_4 and 100 cc. 20% oleum upon 20 g. of $\text{HO}_2\text{AsPhC}_6\text{H}_4\text{AsO}_2\text{H}_2$ (see Kalb) at 20° and crystg. from 5 *N* HNO_3 or 50% AcOH ; this is reduced by $\text{Fe}(\text{OH})_2$ in NaOH , giving *m*-aminodiphenylarsinic-o-arsinic acid, $\text{C}_{12}\text{H}_{13}\text{O}_4\text{NAs}_2$, fine, pale rose needles; upon further reduction in concd. HCl with SO_2 at $60-70^\circ$ *m*-aminoarsanthrene dichloride hydrochloride is obtained as amorphous flakes. Na_2CO_3 gives the colorless oxide, which is oxidized to *m*-aminoarsanthrenic acid, $\text{C}_{12}\text{H}_{11}\text{O}_4\text{NAs}_2$, by H_2O_2 , needles. *m,m'*-Diaminodiphenylarsinic acid, $\text{C}_{12}\text{H}_{10}\text{O}_2\text{N}_4\text{As}_2$, by the reduction of $\text{HO}_2\text{As}(\text{C}_6\text{H}_4)_2\text{NO}_2$ with $\text{Fe}(\text{OH})_2$ and NaOH , pale reddish leaflets. If Fe powder is used to reduce the di- NO_2 acid, the insol. oxide is obtained, which, with HCl , gives the *arsinic chloride dihydrochloride*, $\text{C}_{12}\text{H}_{10}\text{N}_2\text{AsCl}_2\cdot 2\text{HCl}$, felt-like needles. This di- NH_2 acid does not react with AsCl_3 . C. J. WHEAT

Arsanthrene (diphenylenediarsine). LUDWIG KALB. *Ann.* 423, 39-75(1921); cf. Wieland and Rheinheimer, preceding abstr.— $o\text{-O}_2\text{NC}_6\text{H}_4\text{AsO}_2\text{H}_2$ is conveniently prepd. in 90% yield by adding to the diazo soln. from 138 g. $o\text{-O}_2\text{NC}_6\text{H}_4\text{NH}_2$ a mixt. of 120 g. As_2O_3 in 240 cc. 5 *N* NaOH and 220 g. crystd. Na_2CO_3 in 700 cc. H_2O , using as a catalyzer 30 cc. 10% CuSO_4 . Without filtering this is concd. to 2 l. neutralized with concd. HCl , and filtered. Further acid addition ppts. the acid. $o\text{-H}_2\text{NC}_6\text{H}_4\text{AsO}_2\text{H}_2$ (A) is obtained by adding 100 g. of the NO_2 acid to 150 g. Fe powder, 10 g. FeCl_3 and 1.5 l. H_2O , which has been warmed 0.5 hr. at $60-70^\circ$. The yield is 80%. *Diphenylarsinic o-arsonic acid* (B), $\text{HO}_2\text{AsPhC}_6\text{H}_4\text{AsO}_2\text{H}_2$, is prepd. by diazotizing 109 g. A in 1 l. H_2O and 125 g. concd. HCl at -8° with 35 g. solid NaNO_2 and adding a soln. of PhAsONa (135 g. PhAsCl_2 shaken with 480 cc. ice-cold 5 *N* NaOH and then adding 400 cc. *N* Na_2CO_3) together with the diazo soln. to 2 l. ice H_2O . After 12 hrs. the mixt. is filtered, the filtrate dild. with 2 l. H_2O , heated to boiling and the acid pptd. by careful addition of concd. HCl , and the soln. filtered hot. The product is then fractionally pptd. by dissolving in 10 l. H_2O containing Na_2CO_3 and acidifying with AcOH . The first ppt. is *azobenzene-o,o'-diarsinic acid*, $\text{C}_{12}\text{H}_{11}\text{O}_4\text{N}_2\text{As}_2$ (about 2%), further purified by pptg. from a hot alk. soln. with AcOH , yellow or orange-yellow needles, m. 272° . The filtrate is now acidified with HCl . B crystals, as long, 4-sided microleaflets, m. 350° (decompn.). **Barium salt.**—**Copper salt**, insol. in H_2O and dil. AcOH . *o-Nitrodiphenylarsinic acid*, $\text{O}_2\text{NC}_6\text{H}_4\text{As}(\text{O}_2\text{H})\text{Ph}$, from the diazo soln. from 138 g. $o\text{-O}_2\text{NC}_6\text{H}_4\text{NH}_2$ treated with 560 cc. 5 *N* NaOH and the soln. of 223 g. PhAsCl_2 in 800 cc. 5 *N* NaOH , poured simultaneously into 1500 cc. ice H_2O , pale yellow rhomboids from H_2O , m. $197-8^\circ$. Upon reduction with Fe powder as above, *o*-aminodiphenylarsinic acid results, cryst. powder (plates), m. $129-30^\circ$ to a turbid fluid, clears 135° . When 14 g. are diazotized and treated with 7.5 g. As_2O_3 in 15 cc. 5 *N* NaOH and 50 cc. Na_2CO_3 , B is formed in a 26% yield. 60 g. B dissolved by boiling in 600 cc. concd. HCl , treated with SO_2 gas (0.2 g. KI in little water added after some time) gives 11-30 g. *arsanthrene chloride* (C), $\text{C}_{12}\text{H}_5\text{Cl}_2\text{As}_2$, purified first by distn. (from PhAsCl_2) and by crystn. from hot C_6H_6 or CHCl_3 (from D), cm.-long spears, m. $182-3^\circ$, easily hydrolyzed by H_2O or EtOH . The impurity (D) is *diphenylarsino chloride-o-arsine dichloride*, $\text{C}_{12}\text{H}_7\text{Cl}_4\text{As}_2$, found in the mother-liquor of C, fine needles from Et_2O , m. $153-5^\circ$. *Arsanthrene oxide* (E), $\text{C}_{12}\text{H}_5\text{OAs}_2$, results when

C is shaken with excess Na_2CO_3 and Et_2O for several hrs. and crystals from alc. in 4-sided leaflets or may be sublimed, m. 196° . It is insol. in NaOH. $\text{Et}_2\text{O}\cdot\text{HCl}$ gives C.

Arsanthrene, $\text{As}(\text{C}_6\text{H}_4)_2\text{As}$, may be prepd. from C by the action of Zn and HCl or by boiling E with PhNHNH_2 in alc., small orange-yellow rhombic leaflets, which change to orange-red at 170° , to greenish yellow at 290° and m. about 340° . Heated in the air (test-tube) it is slowly oxidized. Attempts to synthesize C by the action of Na upon $\text{BrC}_6\text{H}_4\text{AsCl}_2$ failed, as did those from $\text{C}_6\text{H}_4\text{Br}_2$, AsCl_3 and Na. *o*-Bromophenylarsinic acid, $\text{BrC}_6\text{H}_4\text{AsO}_2\text{H}_2$, from diazotized *o*- $\text{BrC}_6\text{H}_4\text{NH}_2$ and Na_2AsCl_4 , leaflets. Reduced with SO_2 in concd. HCl, *o*-bromophenylarsine dichloride results, thick prisms from petrol. ether, m. 63° , b₁₁ 158° . *o*-Aminophenylarsinic oxide, $\text{H}_2\text{NC}_6\text{H}_4\text{AsO}$, powder, sol. in NaOH and dil. acids. Its diazo soln. proved to be very unstable and evolved N, giving not the expected arsanthrene acid, but the *o*-HO acid in the form of *o*-hydroxyphenylarsinic oxide anhydride, (I) or (II), m. 177° . With HCl this yields *o*-hydroxyphenylarsine dichloride, $\text{C}_6\text{H}_4\text{OCl}_2\text{As}$, large, flat, pale yellow columns, m. $81\text{--}2^\circ$, which gradually decomps., so that after 6 days it



m. $74\text{--}80^\circ$. It is easily hydrolyzed by H_2O . The 3rd expt. was the attempted condensation of $\text{C}_6\text{H}_4(\text{AsCl}_2)_2$ with C_6H_4 and AlCl_3 . *o*-Phenylenediarsinic acid, $\text{C}_6\text{H}_4\text{C}_6\text{H}_4\text{As}_2$, was prepd. from $\text{o-H}_2\text{NC}_6\text{H}_4\text{AsO}_2\text{H}_2$ and Na_2AsO_3 , microneedles with 1 H_2O , does not m. 360° . As a by-product, *o*- $\text{HOC}_6\text{H}_4\text{AsO}_2\text{H}_2$ was obtained. In attempting to prep. the tetrachloride, the acid was treated with SO_2 in concd. HCl, but the resulting product was *o*-phenylenediarsinic oxychloride, $\text{C}_6\text{H}_4\text{OCl}_2\text{As}_2$ (III), 4-sided plates, m. 148° . The above expt. was then abandoned.

C. J. WEST

The influence of substitution in the components upon the equilibria in binary solutions. XXVII. The binary systems of *m*- and *p*-aminophenols with phenols and nitro compounds. ROBERT KREMANN, EGBERT LUPFER AND OTTHAR ZAWODSKY. Univ. Graz. *Monatsh.* **41**, 499-542(1921); cf. *C. A.* **14**, 3408.— PhOH and $m\text{-H}_2\text{NC}_6\text{H}_4\text{OH}$ form an equimol. compd. at 76° and 46.7% PhOH , which forms an eutectic with PhOH at 15° and 69% PhOH , and with $m\text{-H}_2\text{NC}_6\text{H}_4\text{OH}$ at 75° and 44% PhOH . The equimol. compd. for $p\text{-MeC}_6\text{H}_4\text{NH}_2$ and $\beta\text{-C}_{10}\text{H}_7\text{OH}$ is at 43° $p\text{-MeC}_6\text{H}_4\text{NH}_2$ and 81.2° ; the eutectic with $\beta\text{-C}_{10}\text{H}_7\text{OH}$ is at 78° and 34% $p\text{-MeC}_6\text{H}_4\text{NH}_2$, while that with $p\text{-MeC}_6\text{H}_4\text{NH}_2$ is at 38.5° and 88% $p\text{-MeC}_6\text{H}_4\text{NH}_2$. PhNH_2 and $\beta\text{-C}_{10}\text{H}_7\text{OH}$ show a max. point in the curve at 82.2° and 39.2% PhNH_2 ; the eutectic with $\beta\text{-C}_{10}\text{H}_7\text{OH}$ is at 80.5° and 30% PhNH_2 , that with PhNH_2 at -7° and 96% PhNH_2 . In the case of $\alpha\text{-C}_{10}\text{H}_7\text{OH}$ and PhNH_2 , the max. at 32° corresponds to an equimol. mixt. (A) while the one at 28° corresponds to 2 mols. PhNH_2 and 1 mol. $\alpha\text{-C}_{10}\text{H}_7\text{OH}$ (B). The eutectic points are: A and $\alpha\text{-C}_{10}\text{H}_7\text{OH}$, 31.5° and 36.5% PhNH_2 ; A and B at 26.5° and 51.5% PhNH_2 ; B and PhNH_2 , -14° , and 89% PhNH_2 . $\beta\text{-C}_{10}\text{H}_7\text{OH}$ and $m\text{-H}_2\text{NC}_6\text{H}_4\text{OH}$ form an equimol. mixt. at about 57% $\beta\text{-C}_{10}\text{H}_7\text{OH}$. Its eutectic with $\beta\text{-C}_{10}\text{H}_7\text{OH}$ lies at 96° and 74% $\beta\text{-C}_{10}\text{H}_7\text{OH}$, with $m\text{-H}_2\text{NC}_6\text{H}_4\text{OH}$ at 97.5° and 41.5% $\beta\text{-C}_{10}\text{H}_7\text{OH}$. In the case of $\alpha\text{-C}_{10}\text{H}_7\text{OH}$ there is 1 eutectic at 69° and 70% $\alpha\text{-C}_{10}\text{H}_7\text{OH}$. Two dihydroxybenzenes give simple eutectics: $m\text{-H}_2\text{NC}_6\text{H}_4\text{OH}\text{-}o\text{-C}_6\text{H}_3(\text{OH})_2$, 66° and 54% $\text{C}_6\text{H}_3(\text{OH})_2$; $m\text{-H}_2\text{NC}_6\text{H}_4\text{OH}\text{-}m\text{-C}_6\text{H}_3(\text{OH})_2$, 62° and 55% $\text{C}_6\text{H}_3(\text{OH})_2$; $m\text{-H}_2\text{NC}_6\text{H}_4\text{OH}\text{-}1,2,3\text{-C}_6\text{H}_3(\text{OH})_3$, 77° and 48% $\text{C}_6\text{H}_3(\text{OH})_3$. $m\text{-H}_2\text{NC}_6\text{H}_4\text{OH}$ and $p\text{-C}_6\text{H}_4(\text{OH})_2$ form an eutectic at $22\frac{1}{2}\%$ $\text{C}_6\text{H}_4(\text{OH})_2$ and 104.5° , but there is a 2nd point of transformation at 107° and 42% $\text{C}_6\text{H}_4(\text{OH})_2$, corresponding about to 3 $m\text{-H}_2\text{NC}_6\text{H}_4\text{OH}$ and 2 $p\text{-C}_6\text{H}_4(\text{OH})_2$.

$m\text{-H}_2\text{NC}_6\text{H}_4\text{OH}$ and $o\text{-O}_2\text{NC}_6\text{H}_4\text{OH}$ form an eutectic at 43.5° and 98% $o\text{-O}_2\text{NC}_6\text{H}_4\text{OH}$; with $m\text{-O}_2\text{NC}_6\text{H}_4\text{OH}$ the eutectic is at 66° and 86% $m\text{-O}_2\text{NC}_6\text{H}_4\text{OH}$. In the case of $p\text{-O}_2\text{NC}_6\text{H}_4\text{OH}$ an equimol. compd. seps at 85° (56% $\text{O}_2\text{NC}_6\text{H}_4\text{OH}$) which forms an eutectic with $p\text{-O}_2\text{NC}_6\text{H}_4\text{OH}$ at 81° and 70% $p\text{-O}_2\text{NC}_6\text{H}_4\text{OH}$, and with $m\text{-H}_2\text{NC}_6\text{H}_4\text{OH}$ at 83° and 51% $p\text{-O}_2\text{NC}_6\text{H}_4\text{OH}$. The eutectic with $o\text{-C}_6\text{H}_4(\text{NO}_2)_2$ is at 89° and 55% $\text{C}_6\text{H}_4(\text{NO}_2)_2$; with $m\text{-C}_6\text{H}_4(\text{NO}_2)_2$ at 74.5° and 77% $\text{C}_6\text{H}_4(\text{NO}_2)_2$. In the case of $1,2,4\text{-(O}_2\text{N)}_3\text{-C}_6\text{H}_3\text{Me}$ the eutectic is at 65° and 90% $(\text{O}_2\text{N})_2\text{C}_6\text{H}_3\text{Me}$. $p\text{-H}_2\text{NC}_6\text{H}_4\text{OH}$ forms the following eutectic mixts.: PhOH , 31° and 87% PhOH . $\alpha\text{-C}_{10}\text{H}_7\text{OH}$, 82° and 86% $\alpha\text{-C}_{10}\text{H}_7\text{OH}$. $\beta\text{-C}_{10}\text{H}_7\text{OH}$, 106° and 83% $\beta\text{-C}_{10}\text{H}_7\text{OH}$. $m\text{-C}_6\text{H}_4(\text{OH})_2$, 61° and 75% $\text{C}_6\text{H}_4(\text{OH})_2$.

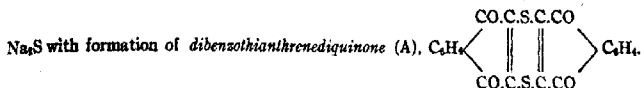
XXVIII. The binary systems of 1,2,4-dinitrophenol with the three isomeric phenylenediamines. ROBERT KREMAN and OTTMAR ZAWODSKY. *Ibid* 543–553; cf. *C. A.* 14, 3408.—1,2,4-($\text{O}_2\text{N})_3\text{C}_6\text{H}_3\text{OH}$ (A) and $o\text{-C}_6\text{H}_4(\text{NH}_2)_2$ form an equimol. compd. at 85° and 62–64% A, which forms an eutectic with A at 85.3° and 74% A, and with $o\text{-C}_6\text{H}_4(\text{NH}_2)_2$ at 72° and 43% A. The curve of A and $m\text{-C}_6\text{H}_4(\text{NH}_2)_2$ passes through a max. at about 100° and 63% of A, which forms an eutectic with A at 53° and 19% A, and with $m\text{-C}_6\text{H}_4(\text{NH}_2)_2$ at 91.5° and 75% A. The curve with $p\text{-C}_6\text{H}_4(\text{NH}_2)_2$ is more complicated. The max. point appears to be at 118° and 83–84% A, 3 mols. A and 1 mol. $p\text{-C}_6\text{H}_4(\text{NH}_2)_2$. The eutectic of this compd. with A is at 107° and 97% A. The diamine forms an eutectic at 88.5° and 37.5% A with a compd. of 1 mol. each. If the curve is extended beyond the eutectic point at 107° , the compn. indicated seems to be 2 A and 1 $p\text{-C}_6\text{H}_4(\text{NH}_2)_2$. These facts again emphasize the steric hindrance effect of the NO_2 group ortho to the HO -group.

C. J. WEST

Di- and triphenylmethane series. I. p -Alkylaminobenzophenones. JAKOB MEISENHEIMER, EUGEN VON BUDKEWICZ and GEORG KANANOW. Berlin. *Ann.* 423, 75–94 (1921).—While 4,4'-tetraalkyldiaminobenzophenones are easily prepd., the unsym. derivs. offer difficulties. Michler and Dupertuis (*Ber.* 9, 1901), who thought they had, "dimethylaminodibenzoylbenzene," really had PhNMeBz , and the former should be stricken from the literature. Attempts to repeat Fischer's work (*Ber.* 10, 958) in which he heated Me_2NPh , BzOH and P_2O_5 in a tube at $180\text{--}200^\circ$, were unsuccessful. From the present work and that of Neundlinger (*C. A.* 9, 2872), it follows that a dimethylaminobenzophenone m. $38\text{--}9^\circ$ does not exist, nor does the di- NO_2 deriv., m. 142° . By the nitration of 7 g. $p\text{-Me}_2\text{NC}_6\text{H}_4\text{COPh}$ with 50 cc. concd. HNO_3 , tetranitromethylaminobenzophenone, $\text{C}_{14}\text{H}_8\text{N}_4\text{O}_8$, m. $175\text{--}5.5^\circ$, results, pale yellow. If PhNMeBz is nitrated in a similar way, tetranitromethylamine, m. 128° , is formed. Nitrated with concd. H_2SO_4 and 2 mol. HNO_3 , a dinitrobenzoylmethylaniline is formed, m. 138° (Hess, 136° , *Ber.* 18, 685). The product of the reaction between $o\text{-Me}_2\text{NC}_6\text{H}_4\text{Me}$, BzOH and P_2O_5 is $N\text{-benzoyl-}N\text{-methyl-}o\text{-toluidine}$, m. $79\text{--}80^\circ$, and not 3-methyl-4-dimethylaminobenzophenone (Fischer). The constitution was confirmed by synthesis from $\text{MeNHC}_6\text{H}_4\text{Me}$ and BzCl . A better method for the prepn. of these unsym. compds. is the action of acid anilides, tert. amines and POCl_3 , followed by sapon., with dil. acids. A 70–75% yield of $\text{Me}_2\text{NC}_6\text{H}_4\text{Bz}$ and 90% of $\text{Et}_2\text{NC}_6\text{H}_4\text{Bz}$ were obtained by this method. [*Methyl- o -tolylamino*] [*phenylimino*] phenylmethane, from 25 g. PhNHBz , 50 g. $\text{Me}_2\text{NC}_6\text{H}_4\text{Me}$ and 25 g. POCl_3 at 160° through the hydrochloride, m. 250° (decompn.), or nitrate, m. 207° , pale yellow, m. 95° . A 90% yield of $p\text{-AcNHC}_6\text{H}_4\text{CO}_2\text{H}$ may be obtained by oxidizing 60 g. $p\text{-AcNHC}_6\text{H}_4\text{Me}$ in a large vol. of H_2O with 210 g. KMnO_4 in 3.5 l. H_2O , added drop-wise during 6 hrs., and pptg. with HCl . This is best sapon. with 7–8 parts half-concd. HCl on the H_2O bath. A 50–60% yield of $\text{Me}_2\text{NC}_6\text{H}_4\text{CO}_2\text{H}$ can be obtained by the use of Me_2SO or MeI . This acid is more conveniently prepd. by the action of COCl_2 upon Me_2NPh at $60\text{--}70^\circ$, raising the temp. to $80\text{--}100^\circ$ as the contents of the flask become thick. Similarly, $p\text{-Me}_2\text{NC}_6\text{H}_4\text{CONHPh}$ is more readily prepd. by the action of COCl_2 upon $\text{Me}_2\text{NC}_6\text{H}_4\text{CO}_2\text{H}$ than through the chloride. $p\text{-}$

Diethylaminobenzanilide, prepd. through the chloride, small, glistening scales, or fine needles, m. 122-3°. *4,4'-Dimethyldiethyldiaminobenzophenone* (Ger. pat. 44,077), from 75 g. $\text{Me}_2\text{NC}_6\text{H}_4\text{CONHPh}$, 150 g. Et_3NPh and 75 g. POCl_3 , m. 92-4°. *Picrate*, $\text{C}_{19}\text{H}_{18}\text{N}_7\text{O}_7$, large, yellow needles, m. 178.5°. [*Methyl-o-tolylamino*][*phenylimino*]-[*p*-*dimethylaminophenyl*] methane, $\text{C}_{20}\text{H}_{20}\text{N}_2$, from 5 g. $\text{Me}_2\text{NC}_6\text{H}_4\text{CONPh}$, 10 g. $\text{Me}_2\text{NC}_6\text{H}_4\text{Me}$ and 5 g. POCl_3 at 150° for 1.5 hrs., m. 132°. II. *Unsymmetrical leuco-bases of malachite-green and crystal-violet series*. JAKOB MEISENHEDER, EUGEN VON BUDKEWITZ, GEORG KANANOW AND JULIUS NERESHEIMER. *Ibid* 95-105.—*4,4'-Dimethyldiethyldiaminobenzhydrol*, $\text{C}_{19}\text{H}_{18}\text{N}_2\text{O}$, by reducing 10 g. $\text{Me}_2\text{NC}_6\text{H}_4\text{COC}_6\text{H}_4\text{NEt}_2$ in 600 cc. alc. with 140 g. 3% Na-Hg, crystals from CS_2 -gasoline, m. 61°. It is very unstable. *4,4'-Dimethyldiethyldiaminotriphenylmethane*, $\text{C}_{21}\text{H}_{20}\text{N}_2$, from 10 g. $\text{Me}_2\text{NC}_6\text{H}_4\text{Bz}$, 20 g. Et_3NPh and 10 g. POCl_3 on a H_2O bath for 5-6 hrs., and warming the HCl soln. of the deep green reaction product with Zn dust, making alk. with NaOH, removing the Et_3NPh with steam, distg. *in vacuo* and crystg. from MeOH, b₁₋₂ 240°, b₁₃₋₁₄ 280-300°, m. 65-7°. It forms cryst. salts with ZnCl_2 , SnCl_4 and PtCl_4 . *4,4',4''-Tetramethyldiethyltriaminotriphenylmethane*, $\text{C}_{23}\text{H}_{22}\text{N}_3$, from 10 g. Michler's ketone, 20 g. Pr_3NPh and 10 g. POCl_3 , m. 98°; the yield is better from the benzhydrol and Pr_3NPh in dil. AcOH. *4,4',4''-Tetramethyldiethyltriaminotriphenylmethane*, $\text{C}_{22}\text{H}_{22}\text{N}_3$, needles, m. 141°, sol. in 80 parts boiling alc. *4,4''-Tetramethyl-4'-diethyltriamino-5'-methyltriphenylmethane*, $\text{C}_{24}\text{H}_{24}\text{N}_3$, by boiling 10 g. $\text{Me}_2\text{NC}_6\text{H}_4\text{CH}(\text{OH})\text{C}_6\text{H}_4\text{NEt}_2$ and 10 g. $\text{Me}_2\text{NC}_6\text{H}_4\text{Me}$ in 75 cc. 10% HCl or 30% AcOH for 6 hrs., difficultly sol. crystals, m. 132-3°; yield 5-15%. *4-Dimethylaminophenyl-4-dimethylamino-1-naphthylphenylmethane*, $\text{C}_{27}\text{H}_{28}\text{N}_2$, from $\text{Me}_2\text{NC}_6\text{H}_4\text{Bz}$ and $\text{Me}_2\text{NC}_6\text{H}_4$, and POCl_3 or better from the benzhydrol, reddish cryst. powder, sinters 95°, m. 105°; org. solvents dissolve it with a blue fluorescence. *Tetraanisylmethane*, $\text{C}_{18}\text{H}_{20}\text{O}_4$, is a by-product in the prepn. of the trianisylmethane, which may be sepd. mechanically and crystd. from Et_2O and EtOH, m. 115-5.5°; pure trianisylmethane m. 47.5°. III. *Preparation of optically active leuco bases of the triphenylmethane dyes*. JAKOB MEISENHEDER AND JULIUS NERESHEIMER. *Ibid* 105-18.—If Rosenstiehl's formula for the triphenylmethane dyes is correct, they should be capable of being split into optically active components. This could not be accomplished. Since there is always the possibility of racemization during the operations, no conclusions are drawn as to the constitution of the dyes. The leuco bases themselves did not form cryst. salts with the optically active acids, probably because of their slight basicity. The NH_2 group was then changed from a tertiary to a quaternary group. *4,4',4''-Tetramethyldiethyltriaminotriphenylmethane dimethiodide*, $\text{C}_{21}\text{H}_{24}\text{N}_2\text{I}_2$, fine powder. *4,4'-Dimethyldiethyldiaminotriphenylmethane methiodide*, $\text{C}_{20}\text{H}_{22}\text{N}_2\text{I}$, needles, m. 153°. This is sol. in Me_2CO . The insol. portion is the *dimethiodide*, which crysts. from MeOH with 1 MeOH as needles, m. 188° (decompn.). With bromomagnesiumsulfonate, a cryst. salt, $\text{C}_{20}\text{H}_{22}\text{O}_2\text{N}_2\text{SBr}$, is obtained containing 1 C_6H_6 , which shows $[\text{M}]_D^{20} 329^\circ$, which is the value for the NH_4 salt of the sulfonate itself. *4-Dimethylaminophenyl-4-dimethylamino-1-naphthylphenylmethane methiodide*, glistening crystals with 1 Me_2CO from Me_2CO . Still another method was to introduce a SO_3H group into the mol., which would permit the use of bases for the sepn. *Dimethyldiethyldiaminotriphenylmethanesulfonic acid*, from 10 g. of the base and 20 cc. fuming H_2SO_4 (7% SO_3), isolated as the sodium salt, which crysts. from EtOH with 1 EtOH, m. 260° (decompn.); the free acid, $\text{C}_{20}\text{H}_{20}\text{O}_3\text{N}_2\text{S}$, amorphous, m. 225-30°. The *quinine salt* forms fine needles, which m. between 225-7° and 214-5°. The rotation was that of the quinine, showing that the sulfonic acid was inactive. The *brucine salt* is an amorphous green product, which may be crystd. from 15-20 parts AcOEt; the sulfonic acid was again inactive. Other salts (*strychnine*, *cinchonine* and *coniine*) were prepd. but the activity in each case corresponded to the alkaloid content. C. J. WEST

Dibenzothianthrenediquinone. (Preliminary communication.) KURT BRASS AND LUDWIG KÖHLER. Techn. Hochschule München. *Ber.* **54B**, 594-7(1921); cf. Ullmann, *C. A.* **15**, 2087.—2,3-Dichloro(or dibromo)- α -naphthoquinone reacts very smoothly with



The reaction occurs in alc. and apparently even in the cold in very dil. soln., as indicated by the deep red-violet color which at once appears; also when the halogen compd. is rubbed in a mortar with crystd. Na_2S , and finally (this is the best method for prepg. A) when the Cl compd. is heated with excess of crystd. Na_2S until almost all the H_2O of the latter, has been driven off; the melt is dild. with H_2O , shaken with air, treated with H_2O_2 to complete the oxidation, filtered and washed with hot H_2O ; the crude A is a violet-red powder and seps. from $\text{C}_6\text{H}_5\text{N}$ in long, pointed, violet-red needles, m. 309° . If the dild. melt is incompletely oxidized with H_2O_2 and then acidified, there is formed a blue ppt. sol. in $\text{C}_6\text{H}_5\text{N}$ with blue color and sepg. in fine dark blue needles. Apparently this is a lower oxidation product than the red A, as the latter can be converted into the same blue product by reduction in acid soln. and the solns. of the blue compd. in $\text{C}_6\text{H}_5\text{N}$ and PhNO_2 redden rapidly in the air. The blue substance is unstable towards alkalis, changing to green and becoming blue again on acidifying. Acetylating reduction of A gives the *tetraacetate*, colorless leaflets from PhNO_2 , of the quinol, *dibenzoetetrahydroxythianthrene*; the *tetraacetate* is best prepd. from the $\text{Na}_2\text{S}_2\text{O}_4$ vat of A with BzCl ; both are easily sapon. by alc. KOH. The free quinol is obtained by passing H_2S into an alk. suspension of the dichloronaphthoquinone; it forms a yellow-white ppt. turned blue by the air. Reduced with Na_2S or alk. $\text{Na}_2\text{S}_2\text{O}_4$, A forms a yellow vat having but slight affinity for unmodanted fibers. CHAS. A. ROUILLER

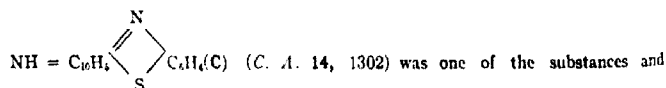
Keto-enol isomerism. XIII. Triphenylvinyl alcohol and 9-benzoylfluorene. KURT H. MEYER AND HANS GOTTLIEB-BILLROTH. Akad. Wiss. München. *Ber.* **54B**, 575-8 (1921); cf. *C. A.* **15**, 77.—The arguments advanced by Biltz for the enol structure, $\text{Ph}_3\text{C}:\text{CPhOH}$ (*Ber.* **32**, 650(1899)), for Saint-Pierre, Delacre and Klingemann's Ph_3CHCOPh (A) have lost their force in view of more recent work. M. and G.-B. have now succeeded in obtaining the very closely related *phenyldiphenyleneethanone* (B) in its two tautomeric forms and a comparison of A with the two forms of B shows beyond doubt that A has the ketone structure. A absorbs no Br in alc. and does not dissolve in alkalis; its tendency to enolize is exceedingly small; even alc. KOH produces no enolization and the Na salt of the enol immediately ppts. the ketone with H_2O . The 9-benzoylfluorenone or B prepd. by Werner's method (*Ber.* **39**, 1287(1906)) is a ketone; in pure form it is completely insol. in cold dil. alkali; the fresh soln. in cold alc. does not decolorize Br but old alc. solns. absorb some Br; NaOH colors alc. solns. intensely yellow and dild. with much H_2O does not ppt. anything. When B is dissolved in the least possible amt. of CHCl_3 , dild. with 4 vols. MeOH, treated with 1.5 times the calcd. amt. of cold dil. NaOH, then with an equal vol. of H_2O , freed from the CHCl_3 and part of the alc. with a current of air, filtered and poured into much very dil. cold HCl, the enol, *phenyldiphenylenevinyl alcohol* (C), is pptd. as a curdy yellowish white substance becoming cryst. on vigorous shaking. Or the intensely yellow soln. of B in a little NH_4Et is cooled, whereupon the NH_4Et salt of C seps. and cold dil. HCl ppts. the C. If the concd. NH_4Et soln. of a weighed amt. of B is added to much strongly cooled alc., quickly treated with concd. HCl and titrated it is found that C is present in the soln. for a short time. The freshly prepd. C dissolves clear in cold dil. alkali; its alc. soln. immediately decolorizes Br; FeCl_3 gives no color with the alc. soln. but a ppt., probably an oxidation product, which quickly redissolves; in the solid form C quickly passes back

into the colorless B, containing only 5.5 and 3% C after 4 and 6 hrs., resp. In soln. an equil. between the 2 forms is established; the C can be detd. by dilg. with 4 vols. cold alc. and either titrating to appearance of a yellow color with alc. Br or adding an excess of alc. Br, then β -naphthol and KI, warming 1 hr. and titrating with $\text{Na}_2\text{S}_2\text{O}_4$ without starch. The following % of enol were found after 3 weeks in various solvents: MeOH 2.8, EtOH 4.5, C_6H_6 8.3, Et_2O 17.0. XIV. Preparation of the enol forms from acetoacetic ester and acetylacetone. KURT H. MEYER AND HEINRICH HOPFF. *Ibid* 579-80.—By a combination of distn. in glass and "aseptic" distn. in quartz (cf. C. A. 15, 77), M. and H. have succeeded in prepg. the enol forms of these compds. $\text{AcCH}_2\text{CO}_2\text{Et}$ was washed 5 times with H_2O , dried with Na_2SO_4 , fractionated 3 times *in vacuo* (the first and last thirds of the distillate being discarded), allowed to stand some days in glass to establish the equil. and, after adding a trace of phthalic acid, distd. under 10 mm. in the Jena glass app. with tall head described in the earlier paper, $1/2$ being collected in a quartz receiver; this (about 30 cc.) showed n_D^{20} 1.4447, corresponding to 88% enol, and when it was at once distd. in the quartz app. already described the first fraction showed n_D^{20} 1.44743 (Knorr, C. A. 5, 2836, gives 1.4480 for the pure enol) and was found by the Br titration method to contain 99.8% enol. $\text{CH}_3\text{C}(\text{CH}_3)=\text{CHCO}_2\text{Et}$ similarly purified and allowed to stand in glass showed n_D^{20} 1.4569 and contained 83% enol (Br titration); of 65 g. distd. in glass under 10 mm., the first half, collected in quartz, had n_D^{20} 1.4610, enol 95%; when this was quickly distd. from quartz the first runnings (2 cc.) showed n_D^{20} 1.4622, enol 99%, whence n_D^{20} for the pure enol is calcd. to be 1.4625; Knorr and Fischer (C. A. 6, 89) give n_D^{15} 1.4609. When the $\text{CH}_3\text{C}(\text{CH}_3)=\text{CHCO}_2\text{Et}$ was distd. directly from quartz three fractions with the following values for n_D^{20} and % of enol, resp., were obtained: 1.4610, 95; 1.4587, 87; 1.5426, 64.

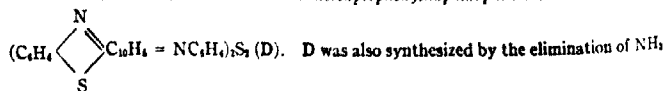
CHAS. A. ROULLER

Migrations of the sulfonic group in aromatic molecules. J. MARTINET. *Rev. gén. mat. color.* 25, 4951 (1921).—The 3 most important causes that influence the solidity of attachment of atoms to a mol. are (1) nature of the atoms and structure of the mol., (2) temp., (3) effect of the solvent, particularly with reference to ionization. When a group is introduced into a mol, it first takes the most mobile position, which is also the least stable. Under the action of an elevation of temp. and in a dissociating medium it passes into positions less replaceable until it remains where the attachments are strongest. The influence of position by the presence of CO_2H , SO_3H , NO_2 , OH, and NH_2 groups is discussed, and attention called to the facts that in sulfonating anthracene by the ordinary method the β -product results, but if the sulfonation is performed in the presence of even a minimum quantity of Hg the α -product is produced. L. W. RIGGS

The action of *o*-aminothiophenol on *o*-quinones. II. KNUD STAHRFOSS. *Helvetica Chim. Acta* 4, 273-81 (1921).—When *o*- $\text{HSC}_6\text{H}_4\text{NH}_2\text{HCl}$ (A) and $\text{NH}_2\text{C}_6\text{H}_4(\text{O})\text{OH}$ (B) reacted in HOAc, 3 products were produced; naphthophenothiazine,



remained in soln. in the form of a salt when the reaction mixt. was treated with H_2O ; a heavy ppt. formed at the same time consisting of a mixt. of 2 compds. both sol. in C_6H_6 , but only one of which was sol. in KOH. The constitution of the alkali-sol. compd. has not yet been detd., but the other substance was found to be *o*-mercaptothiophenyl-naphthophenothiazine disulfide,



from the action of C upon the disulfide of *o*-HSC₆H₄NH₂ in HOAc and HCl; D was obtained by dilg. the reaction mixt. with H₂O and KOH and extg. with C₆H₆. 10 g. of A and 10 g. of 4-amino-1,2-naphthoquinone were treated with enough 80% HOAc to form a paste and then heated gently to boiling with stirring for 0.5 hr.; the reaction mixt. was gradually dild. with 2 l. of hot H₂O; the ppt. was filtered and washed with hot H₂O till no more color passed through; the solid was extd. with 3% KOH at 80° till the ext. showed no more green coloration; D was now filtered, washed, dried and crystd. from C₆H₆. It formed red needles, m. 285°.

ROGER ADAMS

Reactions of the photochemical increase in valence of oxygen (KÖGEL) 3. Cause and composition of the insoluble deposits in oil of mustard (KUNZ-KRAUSE) 17. Pressure oxidation of paraffin wax (FISCHER) (FISCHER, SCHNEIDER) (SCHNEIDER) (SCHNEIDER, JANTSCH) (FISCHER, SCHNEIDER) 27. Oxidation of paraffin wax by air at ordinary pressure (SCHNEIDER) 27. Pressure oxidation of montan wax (FISCHER, SCHNEIDER) 27. Pressure oxidation of phenols (FISCHER, SCHRADER) 26.

Acetylating chlorohydrocarbons. G. T. KOCH and A. L. STALLKAMP. U. S. 1,374,666, Apr. 12. Chlorohydrocarbons such as may be obtained by chlorinating C₆H₆, are heated to about 120–230° under 200–225 lbs. pressure per sq. in. with Na acetate, in the presence of batchite (activated C) as a catalyst, in order to obtain a good yield of acetic esters, especially *amyl acetate*.

Copper catalyst. A. A. BACKHAUS. U. S. 1,375,345, Apr. 19. A catalyst adapted for producing *aldehydes* by oxidation of alcs. is formed by treating Cu gauze disks with HOAc and air in order to form Cu acetate on the Cu and then reducing the acetate with H to deposit finely divided reduced Cu on the bulk metal.

Catalyst for producing aldehydes from alcohols. A. A. BACKHAUS and F. B. ARENTZ. U. S. 1,376,065, May 3. A Cu tube is filled with parallel disks of Cu gauze which may be contiguous or spaced apart by rings. In order to make the gauze disks active for the catalytic conversion of EtOH to AcH, they are treated with a soln. of nitrate of Cu or Ni and then with NH₃ gas to ppt. metal hydroxide on the gauze. This hydroxide is then partially decomposed by heating to 300° or above and is reduced in H heated to about 300°. Fe or Cr compds. may be similarly prepd. for use as catalysts.

Maleic acid. C. R. DOWNS. U. S. 1,374,720, Apr. 12. In the production of maleic acid by the partial oxidation of C₇H₆ by the action of air at 400° in the presence of a catalyst metallic Hg is enclosed in tubes around which the reacting materials are passed and this liquid Hg by its vaporization will regulate the temp. attained and prevent undue heating. The Hg may be kept under pressure to elevate its b. p.

Catalytic oxidation of fluorene. J. M. WEISS and C. R. DOWNS. U. S. 1,374,695, Apr. 12. Fluorenone is produced by oxidizing fluorene vapor with air at a temp. of 300–700° in the presence of a catalytic metal oxide.

Catalytic oxidation of naphthalene. C. R. DOWNS. U. S. 1,374,722, Apr. 12. C₁₀H₈ vapor is partially oxidized to form phthalic anhydride by subjecting the vapor to the action of an oxidizing gas such as air at a temp. of about 450° in the presence of Al₂O₃ as a catalyst.

Anthraquinone. C. R. DOWNS. U. S. 1,374,721, Apr. 12. In the production of anthraquinone by the oxidation of C₁₄H₁₀ vapor in the presence of a catalyst the reacting materials are passed around tubes containing liquid Hg, which prevents overheating of the reaction mixt. by abstracting heat of vaporization.

5-Phenyl-5-ethyl-2,4-diketotetrahydrooxazole. J. ALTWEGG and D. ERIN. U. S. 1,375,949, Apr. 26. 5-Phenyl-5-ethyl-2,4-diketotetrahydrooxazole is made by dissolving 450 g. PhEtC(OH)CONH₂ in 3 l. of boiling toluene, adding 700 g. anhyd. K₂CO₃

with stirring, slowly adding 300 g. of CICO_2Et , heating the mixt. for an hr., adding cold H_2O , decanting and treating the liquid with H_2SO_4 . An oily substance seps. out which after some time solidifies to a cryst. mass. Most of the product b_p 178° and crystallizes after cooling. The crystals m. 63° , are almost insol. in cold H_2O , slightly sol. in hot H_2O , easily sol. in ether, alc. and C_6H_6 , less sol. in CHCl_3 and slightly sol. in petr. ether. The aq. soln. has an acid reaction and forms salts with alkali or alk. earth metals and Mg. The 5-methyl derivative, m. 70° , may be similarly formed from atrolactamide.

Anthranol. A. G. PERKIN. U. S. 1,375,972, Apr. 26. See Brit. 151,707 (C. A. 15, 690).

11—BIOLOGICAL CHEMISTRY

MATTIE L. HEFT, EDGAR G. MILLER, JR., AND WILLIAM J. OES

A—GENERAL

FRANK P. UNDERHILL

Histochemical demonstration of purines. ERWIN BAUER. Budapest. *Arch. path. Anat. (Virchows)* 228, 528-32(1920).—An application of the Courmont method used by the author in his study of the adrenal, to the demonstration of purines within cells. Under normal conditions the same organs and cells contain demonstrable (free) purines that also contain iron-free pigment. These results are interpreted as additional proof of his contention that iron-free pigment and the so-called "wear and tear" pigment are purine derivs. The following tissues constantly contain purine as well as silver granules: Skin, adrenal cortex, liver cells, the cells of sympathetic ganglia of the central nervous system. They were frequently but not constantly found in the epithelial cells of damaged kidney tubules. In pathological conditions, purines were found during autolysis, karyolysis, degeneration and in tumor cells. E. B. FRINK

The photoelectric theory of vision. J. H. J. POOLR. *Phil. Mag.* 41, 347-57 (1921).—Direct expts. have been made to test the photo-elec. theory of vision recently put forward by Joly. An indirect test of photoelec. action was made by ascertaining whether rhodopsin, the supposed photosensitive constituent of the eye, can act as a sensitizer to the photographic plate. The result was negative. Direct tests were then made to detect electrons liberated under the action of light on black (eye) pigment, and on the retina of a frog eye. These results were also negative and afford no support of a photoelec. theory of vision. But it is still regarded as possible that electrons are liberated but do not escape so that they can be detected as such. S. C. LIND

Dependence of the osmotic value on some outside factors. J. BACHER. *Beih. z. botan. Centr.* 37, 63-113(1920); *Physiol. Abstracts* 5, 331.—By the osmotic value B. means that concn. of a soln. of sucrose in which half the cells are weakly, yet definitely, plasmolyzed. This value increases with decreasing temp., and decreases with rising temp. It also increases in illumination, and decreases in darkness. Red light acts more strongly than green light of the same intensity, and green more strongly than blue. The osmotic value depends on the concn. of the external soln. in which the material (e. g., *Elodea*) is cultivated, and the time for which it is cultivated. H. G.

Action of sucrose on substances resembling inulin. H. COLIN. *Bull. soc. chim. Biol.* 2, 157-9(1920); *Physiol. Abstracts* 6, 97.—Pseudo-inulin, inulinin, and hellanthinin are resistant to the action of sucrose, but synanthrine is hydrolyzed. H. G.

Chemistry of savoriness. F. BARRAL AND A. RANC. *J. psychol.* 17, 16-30(1920). *Physiol. Abstracts* 5, 286.—A systematic study of the influence of substituting groups on the taste of org. compds., which, the authors hope, will form a useful preliminary to the investigation of the nature of the taste sensation itself. H. G.

Medical problems of flying. By a committee (H. HEAD, Chairman). *Med. Res. Council* 1920, Special report, Ser. 53. (I) **Medical aspects of high flying.** J. L. BIRLEY. *Ibid* 5-9. (II) **Testing for "oxygen-want."** G. DREYER. *Ibid* 10-13.—A description is given of the app. used. Air dild. with N is employed. The observer is not exposed to "O-want." (III) **The bag method for investigating air disabilities.** M. FLACK. *Ibid* 14-17. (IV) **Reaction of aviators to diminished oxygen-pressure.** C. O. H. CORBETT AND H. C. BAZETT. *Ibid* 18-69.—Expts. were carried out by Flack's bag method, by breathing through a long tube, and by using Dreyer's app. The last method is the best for detg. the capacity of the subject to stand diminished O tensions. The reaction to O-want corresponding to 18,000 ft. is pulse-rate increased about 30%, pulse-pressure about 36%, and, after 30 mins., some degree of blood concn. The respiration slows and deepens, and increases the ventilation 50%. Failure to withstand O-want may be associated with an excessive, sub-normal, or periodic respiratory response; in some cases the cardio-vascular system apparently is faulty. Flying men may claim to be perfectly fit at high altitudes, but may actually be quite inefficient owing to sleepiness. In apparently healthy individuals symptoms of O-want may in rare cases occur below 10,000. (V) **The value of oxygen to aviators at relatively low altitudes.** M. FLACK AND C. B. HEALD. *Ibid* 70-80.—The effect of O administration on the cardio-respiratory system was detd. by observing the pulse-rate, the ability to hold the breath, and the arterial pressure; the effect on the nervous system was tested by McDougall's dotting machine. It is concluded that the administration of O abolishes in short flights or delays in long flights the onset of cardio-respiratory and nervous fatigue. After a flight, O improves the cardio-respiratory condition. (VI) **Selection of candidates for flying.** M. FLACK AND A. P. BOWDLER. *Ibid* 81-92. (VII) **Tests for flying efficiency and flying strain.** M. FLACK. *Ibid* 93-141. (VIII) **Temperament and service flying.** J. L. BIRLEY. *Ibid* 141-83. (VIII) **Respiratory tests for ability to stand high altitudes.** H. C. BAZETT. *Ibid* 184-202. (X) **Respiration of airmen.** G. BRISCOE. *Ibid* 203-13.—In airmen unfit for flying the rate of metabolism at rest is slightly higher than in fit men. When marked nervous symptoms are present the rate was high; this increase is not due to prolonged flying *per se*. A frequent history of concussion in patients with high metabolism rate was noted, as was also the large proportion of quick, shallow breathers in whom was found a restricted dead space. Alveolar CO_2 was normal. (XI) **Sense of stability and balance in the air.** H. HEAD. *Ibid* 214-56. (XII) **Metal aptitude for aviation.** W. H. R. RIVERS, T. S. RIPPON AND E. G. MANUEL. *Ibid* 257-64. (XIII) **"Reaction time" of flight cadets.** L. E. STAMM. *Ibid* 265-72. Through *Physiol. Abstr.* 5, 442. H. G.

Lymphocytosis and pepsin formation. A. J. PAVLOVSKY. *Semana med.* 27, 398-405(1920); *Physiol. Abstracts* 6, 55.—By using a dog with a gastric fistula it is shown that injection of emulsion of pancreas leads to a lymphocytosis and to an increase of over 50% in the pepsin content of the gastric juice. Injection of spinal cord emulsion produces a polynuclear leucocytosis, but produces no effect on leucocytes or gastric juice. The parallel variations in the number of lymphocytes and the activity of the gastric juice are explained by the theory that the proteolytic enzyme of the lymphocytes is liberated into the blood, and thence secreted by the gastric glands. H. G.

The enzymes of the brain. I. A. OSOVSKEI. *Russ. Physiol. J.* 2, 68-90(1919); *Physiol. Abstracts* 5, 458.—Lipase, esterase, and 3 glucosidases—amylgdalase (emulsin); salicinase, and cerebrosidase—were found in the brain. Amylase and catalase are more abundant in the grey matter. Glutininase and indophenoloxidase were found exclusively in the grey matter. In patients suffering from destructive lesions of the brain emulsin was found in their cerebrospinal fluid in early stages of the disease. This fact is of diagnostic value. H. G.

Nature of antienzymes. B. I. SLOVZOV AND V. I. XENOPHONTOVA. *Russ. Physiol. J.* 2, 261-7(1919); *Physiol. Abstracts* 5, 450.—The antitryptic substance of the serum can be extd. with CHCl_3 but not toluene. It is most probably a lipid substance. Fatty acids have similar powerful antitryptic properties which are reduced by iodizing. On this ground it seems that the unsatd. fatty acids have a greater antitryptic action than the satd.

H. G.

Action of thyroid gland hormones. I. ASHER. *Therap. Ilabmonatsh.* 34, 222-4 (1920); *Physiol. Abstracts* 5, 315.—A concise summary of the present state of knowledge of the subject.

H. G.

Chemistry of enzymes. TH. BOKORNY. *Allgem. Brau. Hopfenzeit.* 1920, 705-6, 713-4; cf. *C. A.* 14, 2497.—From the fact that enzymes evolve N with HNO_3 , their amino character is argued. The effect of HNO_3 , H_2SO_3 and H_2SO_4 on emulsin was studied. H_2SO_3 was not more fatal to emulsin than H_2SO_4 , although on living cells it is more so, presumably on account of its action on the aldehyde groups of the protein mol. From this, the absence of aldehyde groups from enzymes is argued. Working on yeast, it was found possible to kill yeast cells by means of H_2SO_4 , CH_3O , and HgCl_2 without inhibiting the activity of zymase. Dextrose, although directly fermentable, does not ferment more rapidly than sucrose or maltose. It is suggested that monose sugars obtained by the resolution of the higher sugars are more rapidly attacked by zymase when in the nascent state.

J. C. S.

Combination of mineral salts with organic colloids and the condition in certain growths. ALBERTO SCALA. *Ann. igiene* 30, 251-73(1920).—S. has shown previously (cf. *C. A.* 14, 1346) that acid is liberated by the contact of certain neutral salts with colloids, such as gelatin, agar-agar and muscle flesh, in a degree which depends on the nature and the degree of dissoc. of the salt and on the properties of the colloid. The phenomenon is attributed to a readier hydrolysis of the amt. of the adsorbed salt; if the washing is continued, a neutral and finally an alk. series of waters are obtained, provided that the base of the salt used is sol. in water; heavy metals are retained by the colloid. The salts of the alk. earths behave similarly to those of the alkali metals, since their bases are more or less sol. in water. Al behaves as a heavy metal, since its hydroxide does not dissolve. Union with an insol. cation does not influence the behavior of gelatin, and possibly of other colloids, towards salts. The mineral salts in the turnip, potato, radish, cucumber, pumpkin, and parsnip are united to the colloid in the same manner as in the artificial mixts., and behave in an exactly similar manner when treated with water. The compds. are very stable when preserved in an ice-chest, but are irreversibly changed when warmed at $50-70^\circ$, so that the acid is very rapidly removed by water. S. considers that undue attention has been paid to the *org. components of the exts. in the investigation of accessory food factors*, since frequently a very large proportion of the inorg. substances passes into the water, alc., and acid. It is readily possible that a gap is produced in the series of necessary inorg. nutrient substances by the one-sided administration of a certain nutriment. Substances of the hydroxypyridine series may also possibly act as carriers for inorg. materials, which they readily adsorb in alc. soln. Antiscorbutin shares the slight stability towards heat of the colloidal salt complexes; the acid components which are liberated on heating readily pass into the wash or boiling waters. The residue can lose bases when further washed, but possibly still contains the heriberi vitamine, which is stable in boiling water. S. further considers that decomposition of the colloid-salt complex is possible under the influence of varying physical and psychic stimuli, thus establishing a connection between the pathology and therapeutics of many diseases, particularly those of the neoplasms.

J. C. S.

Enzymes. V. Resistance of ptyalin to the action of hydrochloric acid in the presence of starch. D. MAESTRINI. *Atti accad. Lincei* [v] 20, II, 391-4(1920);

cf. C. A. 15, 2107.—Starch paste protects mixed human saliva from the destructive action of HCl, the highest concn. of the latter which the enzyme is able to withstand for 3 hrs. without irrecoverable loss of the amylolytic properties being 0.16%. The importance of the substrate for the preservation of the enzymic activity of saliva is hence evident.

J. C. S.

Limits of the precipitation of mucin by acids and by zinc salts. L. DEJUST. *Bull. soc. chim. biol.* 2, 208-10(1920).—The mucin employed for this investigation was prepd. from the sub-maxillary glands of oxen by extn. with 0.5% KOH, and acidification of the ext. with AcOH. The mucin, after two pptns., was washed with alc. and ether. It contained 13.69% of N. The pptn. of mucin from soln. by acids and Zn salts was studied.

J. C. S.

Enzymic investigations of certain green algae. KNUT SJÖBERG. *Fermentforschung* 4, 97-141(1920).—The very considerable influence of nutriment on the formation of enzymes has been examd. at the instances of *Ulothrix zonata*, *Cladophora glomerata*, *Cl. fracta*, and *Spirogyra*. Amylase is decreased in culture solns. which contain sucrose, lactose, maltose, dextrose, or galactose, but is slightly increased in those contg. starch, Ca tartrate, or Ca lactate. K chloride or phosphate is without influence. Pre-treatment of the algae with alc. (96%) increases the amylase action (the max. is attained in 3 hrs. after treatment), and a similar effect is produced by CHCl₃. No effect is produced by toluene or thymol. Sunlight, which increases the formation of starch in algae, does not influence the production of amylase. The action is diminished by desiccation. Optimum action in a phosphate mixt. is observed at $p_H = 4-5$ in the case of *Cl. glomerata*. Saccharase is increased in solns. of sucrose, dextrose, or lactose, slightly diminished by maltose and galactose, and unaffected by glycerol. Catalase is diminished in activity by pre-treatment with alc. or by the presence of CHCl₃ or toluene, but is increased by drying the algae.

J. C. S.

Toxic actions in enzymic processes. IV. Electromotive measurements of the combination of silver and copper with saccharase and other organic compounds. H. VON EULER AND OLOF SVANBERG. *Fermentforschung* 4, 142-83(1920); cf. C. A. 15, 1539. —It has been shown previously that Ag becomes de-ionized by the formation of complex compds. with saccharase. Numerous substances have now been comparatively examd. electrometrically in order to ascertain whether any of them possesses an approx. similar affinity for Ag ions. This is found to be the case with egg albumin (Sörensen), cysteine, and a nucleic acid, so that it would appear that the action of the saccharase mol. is due to the presence of the SH group and the components of the nucleic acid; it is shown that these have much less affinity for the cupric than for the Ag ion, and the lower toxicity of Cu salts towards saccharase is thereby explained. The paper concludes with a summary of the results described in the 4 communications. J. C. S.

New formation of the diastatic enzyme outside the living cell. WERNER TESCHENDORF. *Fermentforschung* 4, 184-90(1920).—The degradation of starch to the achromatic point was not observed in expts. conducted in accordance with the recent directions of Biedermann (C. A. 14, 1345) unless the preps. were bacteriologically contaminated; the addition of saliva ash did not bring about this result. Re-examn. of Schwiening's expts. (*Arch. ges. Physiol. (Pflüger's)* 58, 222-8(1894)) did not show a spontaneous decompn. of starch in the presence of albumin when precautions were taken to ensure the freedom of the solns. from bacteria.

J. C. S.

Influence of the bile and bile salts on the most important digestive enzymes. J. TREMMINCK GROLL. *Ned. Tydschr. Geneeskunde* 64, 1157-68(1920); cf. C. A. 14, 2937. —In order to eliminate the effects due to varying alkalinity, a phosphate buffer mixt. giving a const. p_H was added to the solns. contg. bile and to the control solutions. Pancreas amylase becomes increasingly activated by bile in concns. of 0.066% to 6%.

Saliva amylase is activated by very slight concns. of bile (about 0.1%); in medium concn. the latter is without effect, but exerts a restrictive action if present to the extent of more than 5%. It does not appear to influence the action of the lipases on solns. of triacetin or monobutyrin. The marked acceleration of the fission of oils seems to depend on the better emulsification of the latter in the presence of bile salts. Proteases and pepsin do not act on fibrins if p_H is smaller than 3.1; bile therefore has a restrictive action. [With C. N. VAN DER MEER.]—In the case of trypsin, bile does not appear to have any direct influence on the fermentative fission of amino acids, which, however, it accelerates by altering the coagulated proteins. J. C. S.

Extractive substances of muscular tissue. XX. Carnosine and its compounds. I. A. SMORODINZEV. *Russ. Physiol. J.* 2, 285-97 (1919); cf. *C. A.* 9, 3088.—Descriptions are given of carnosine and its methods of extr., and also of the known derivs. of carnosine, the following being now described for the first time. The *sulfate*, $(C_4H_{10}O_3N_2)_2 \cdot H_2SO_4$, decomposes at 238-40°, the *orthophosphate* at 205-7°, the *metaphosphate* at 200-3°, the *iodate* at 188-90°, and the *oxalate*, $(C_4H_{10}O_3N_2)_2 \cdot C_2H_2O_4$, at 218-18°. The *phosphotungstate*, $(C_4H_{10}O_3N_2)_2 \cdot 12WO_3 \cdot P_2O_5 \cdot 16H_2O$, is very slightly sol. in water, turns blue in the light, and remains undecomposed at 250°. The *phenylcarbamido-deriv.*, $C_4H_8O_3N_2 \cdot C_6H_5 \cdot NCO (+1\frac{1}{2} H_2O \text{ or } \frac{1}{2} EtOH)$, decomposes at 178-80°. J. C. S.

The muscarine question. II. ψ -Muscarine (synthetic muscarine). ALBERT B. WEINHAGEN. *Z. physiol. Chem.* 112, 13-27 (1920); cf. *C. A.* 14, 929.—On the assumption that synthetic muscarine is identical with the natural base, but that the difference in the pharmacol. action is due to the presence of by-products, W. has studied the various products resulting in addition to synthetic muscarine, from the action of HNO_3 on choline chloroplatinate. Besides the nitrous ester of the double salt, a compd. similar to that described by Ewins, various other substances, including NMe_3 , were identified. It is assumed that such degradation products may be responsible for the curare-like action of "synthetic muscarine." J. C. S.

The bile acids. VIII. MARTIN SCHENCK. *Z. physiol. Chem.* 112, 38-44 (1920); cf. *C. A.* 15, 1730.—The acid obtained by Letsch (*C. A.* 4, 597) by the action of a mixt. of HNO_3 and H_2SO_4 on cholic acid is identical with biloidanic acid. The neutral methyl ethers of both acids have also been found to be identical. J. C. S.

Casein viscosity studies (ZOLLER) 2.

CHRISTESCO, SYRFAN: *Energie mecanique de l'organisme humain*. Paris: La Librairie Moderne, 19 boulevard St. Michel. 70 pp. 3 fr. 50. For review see *Rev. electrochim.* 15, 134 (1921).

DESGREZ, A.: *Precis de chimie medicale*. Paris: J. B. Bailliere. 476 pp. For review see *Rev. sci.* 59, 351 (1921).

SCHAXEL, J.: *Über die Darstellung allgemeiner Biologie*. Berlin: Gebrüder Bornträger. For review see *Umschau* 25, 385 (1921).

B—METHODS AND APPARATUS

STANLEY R. BENEDICT

A new and improved method for identifying human blood. ANGELO DE DOMINICIS. *Boll. chim. farm.* 59, 241-4 (1920).—For the identification of human blood on weapons and non-absorbent surfaces the following procedure is recommended: Pour a clear viscous soln. of celluloid in amyl acetate on the part to be examd. and after it has dried completely remove a transparent film carrying a superficial layer of the blood after loosening the edges with a needle. Fix the film to a microscopic slide by means of a little egg albumin applied to the edges. Under the microscope the diam. of the blood corpuscles can then be measured. A. W. DOX

New methods for estimating enzymatic activities of duodenal contents of normal

men. C. W. McCLECKE, A. S. WETMORE AND LAWRENCE REYNOLDS. Peter Bent Brigham Hosp., Boston. *Arch. Intern. Med.* 27, 706–15 (1921).—The duodenal contents are centrifuged until clear or only slightly turbid. The *proteolytic activity* is detd. with casein as a substrate, the total amt. of N made non-precipitable by HPO_3 in a fixed time being detd. The following solns. are required: 0.2 M PO_4^{---} of p_H 8.4, prepd. by mixing 20 cc. of soln. containing 27.23 g. KH_2PO_4 per liter with 980 cc. of soln. containing 35.63 g. $\text{Na}_2\text{HPO}_4 \cdot 2\text{H}_2\text{O}$ (air-dried) per liter; casein soln., to 100 cc. of this PO_4 soln. vigorously rotated in a flask, add 1 g. casein (Van Slyke and Bosworth, *C. A.* 7, 2044) and 4 cc. 0.1 N NaOH, warm to 57° and rotate until all casein has dissolved; HPO_3 , fuse commercial HPO_3 in a graphite mortar until white fumes appear, then pour into pie plates floating on cold H_2O . Prep. 25% solns. as required by triturating with H_2O in a mortar. *Procedure*.—In a test-tube (100×10 mm.) place 9 cc. casein soln. and place in H_2O -bath at 40° for 5 min., then add 1 mixt. of 1 cc. duodenal contents and 49 cc. 0.2 M buffer soln. and keep at 40° for 30 min. Add 2 cc. fresh 25% HPO_3 , mix and filter. Det. N in 1 cc. filtrate by the method of Folin and Wu (*C. A.* 13, 2541). *Lipolytic activity*.—The substrate is an emulsion of 4 parts cottonseed oil, 1 part gum acacia and 2 parts H_2O prepd. according to U. S. P. 400 cc. of this are mixed with 600 cc. H_2O in an emulsifying machine at 300–500 kg. per sq. cm. This mixt. may be bottled, sealed and sterilized at 15 lbs. pressure and will then keep indefinitely. Before using, it is mixed with an equal vol. of the buffer soln. which is a 0.33 M PO_4^{---} soln. prepd. by mixing 20 cc. of soln. contg. 40.83 g. KH_2PO_4 per liter with 980 cc. of soln. contg. 53.44 g. $\text{Na}_2\text{HPO}_4 \cdot 2\text{H}_2\text{O}$ per liter. To 9 cc. of this mixt. warmed in a H_2O bath to 40° , add 1 cc. of mixt. of 1 cc. duodenal contents and 49 cc. 0.33 M buffer soln. and keep at 40° for 1 hr. Rinse into a 150-cc. Erlenmeyer flask with 20 cc. neutral 95% EtOH, add 10 drops 1% phenolphthalein and titrate, hot, with 0.1 N NaOH in EtOH. *Amylolytic action*.—Dissolve 4 g. sol. starch in 100 cc. hot H_2O , cool and add 100 cc. 0.2 M buffer soln. (see proteolytic activity). To 9 cc. warmed to 40° , add 1 cc. of mixt. of 1 cc. duodenal contents and 24 cc. 0.2 M buffer soln. and keep at 40° for 30 min., then pipet 2 cc. into 2 cc. Cu soln. of Folin and Wu (*C. A.* 14, 2353) and proceed with detn.

I. GREENWALD

Dinitrosalicylic acid: a reagent for the estimation of sugar in normal and diabetic urine. JAMES B. SUMNER. Cornell Univ. *J. Biol. Chem.* 47, 4–9 (1921).—Na dinitrosalicylate, in alk. soln., is reduced to a deeply colored substance by glucose, by uric acid and polyphenols in the presence of glucose and by the other constituents of the urine after destruction of the glucose with alkalies. S., therefore, subtracts from the apparent glucose content a figure obtained as indicated below for the non-glucose reducing constituents. 3,5-Dinitrosalicylic acid is prepd. by adding 15 g. salicylic acid in small portions to a well cooled mixt. of 75 g. concd. H_2SO_4 and 15 g. concd. HNO_3 , pouring the mixt. into 800 cc. H_2O , cooling and filtering. The crystals are dissolved in dil. Na_2CO_3 , the soln. is filtered and the Na dinitrosalicylate is salted out by the addition of a large excess of satd. Na_2CO_3 soln. and cooling. The salt is filtered out and washed with satd. Na_2CO_3 soln. The material is dissolved in hot H_2O , filtered and the free acid pptd. by adding a large excess of HCl. After cooling, the dinitrosalicylic acid is filtered off, pressed, recrystd. from a small amt. of hot H_2O and dried at 100° . Dissolve 2 g. of this prepn. in 70 cc. hot H_2O and 10 cc. 20% Na_2CO_3 , cool and dil. to 100 cc. *Determination*.—Pipet 1 cc. urine into a test-tube, 1.5×15 cm., add 1 cc. 2% dinitrosalicylate soln. and 2 cc. 1.5% NaOH. Mix, plug with cotton and heat in boiling H_2O for 5 min. Cool and dil. to 25, 50 or 100 cc. according to depth of color. Mix and compare in a colorimeter with a standard similarly prepd. from 1 cc. glucose soln. (= 1 mg. glucose) and dild. to 25 cc. If more than 4 mg. glucose are indicated, repeat with dild. urine and the amt. so found is corrected for the non-sugar reducing substances by

measuring 1 cc. urine and 1 cc. 3% NaOH into a test-tube and heating in boiling H_2O for 15 min. Cool and add 1 cc. of soln. containing either 1 or 0.5 mg. glucose, according to whether the total reduction of the urine was more or less than 1 mg. per cc. calcd. as glucose. Complete the detn. as above, and subtract from the result obtained the amt. of glucose added. The remainder is the "glucose equivalent" of the uric acid, polyphenols, etc. and should be subtracted from the amount found in the first detn. to give the correct amt. of glucose in the sample. By this method, 10 normal urines gave an av. of 0.067% total sugar, 0.55% fermentable and 0.012% non-fermentable. I. G.

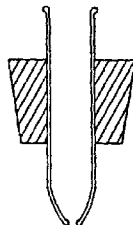
The substitution of turbidimetry for nephelometry in certain biochemical methods of analysis. W. DENIS. Tulane Univ. Med. School. *J. Biol. Chem.* **47**, 27-31(1921).—Using the Duboscq colorimeter as a turbidimeter, D. has tried Lyman's method for Ca (*C. A.* **11**, 1440) and Bloor's methods for fat and P (*C. A.* **12**, 2588), substituting the turbidimetric comparison for the nephelometric. Satisfactory results were obtained. Turbidimetric comparisons may be made over a greater range than nephelometric and it is, therefore, unnecessary to have so many standards. The possession of 1 simple instrument permits of both kinds of detns., colorimetric and turbidimetric. See also Greenwald, *C. A.* **9**, 1925, for detn. of P. I. GREENWALD

Note on the gasometric determination of nitrogen. RAYMOND L. STEHLE. Univ. Penn. *J. Biol. Chem.* **47**, 11(1921).—The O_2 liberated in the method described by S. (*C. A.* **15**, 693) is due to the $CuSO_4$ added in the Kjeldahl digestion. If this addition be omitted, the use of the alk. pyrogallate is unnecessary. I. GREENWALD

The gasometric determination of urea. RAYMOND L. STEHLE. Univ. Penn. *J. Biol. Chem.* **47**, 13-17(1921).—The removal of the NH_3 from urine by means of permute (Youngburg, *C. A.* **15**, 1323) makes it possible to apply the reaction with NaOBr to the accurate detn. of urea in urine. Under the conditions employed, uric acid, allantoin, hippuric acid, glycine and creatinine do not yield amts. of N_2 sufficient to interfere with the urea detn. Creatine liberates 2 of its 3 N atoms and, if present in considerable amt., will make the results too high. *Method.*—Dil. the urine to 10 times its vol. Shake 25 cc. of this dild. urine with 4 g. permute for 4 min. and centrifuge or filter the mixt. Introduce 1 cc. of the liquid into the Van Slyke CO_2 app. (*C. A.* **11**, 2208), rinsing in with 1 cc. H_2O and following it with 1 cc. NaOBr (prepd. from equal vols. of soln. A containing 12.5 g. NaBr and 12.5 g. Br_2 per 100 cc. and of B containing 28 g. NaOH per 100 cc.). Lower the Hg to the 50 cc. mark, shake the app. vigorously for 0.5 min., collect the H_2O soln. in the proper chamber, admit Hg to the measuring chamber and read the vol. in the usual manner. Correction is made for the soly. of air in the dil. urine (assumed to be the same as in H_2O) and in the wash H_2O and in the NaOBr, 0.006 cc. from 15° to 20° and 0.005 cc. from 21° to 25°. The calcn. of the vol. is evident. One cc. N_2 (0°, 760 mm.) weighs 1.2507 mg. Cf. also Stehle, *C. A.* **15**, 693. I. G.

The determination of inorganic sulfate, total sulfate and total sulfur in urine by the benzidine method. CYRUS H. FISKE. Harvard Med. School. *J. Biol. Chem.* **47**, 59-68(1921).—The benzidine methods already described (Rosenheim and Drummond, *C. A.* **8**, 2404; Drummond, *C. A.* **10**, 1359; Gauvin and Skarzynski, *C. A.* **8**, 3192) give results that agree fairly well with those obtained by pptn. with Ba in mixed 24-hr. urines, but with 1 hr. specimens the amts. of H_2PO_4 and of Cl present may be sufficient to introduce serious error. F. believes that for short-period metabolism work, a satisfactory method must give accurate results in the presence of 10 mg. P or 60 mg. Cl for each mg. S present as inorg. SO_4 . The following methods will accomplish this and are recommended. Transfer a vol. of urine containing from 5 to 10 mg. S as inorg. SO_4 to a 50-cc. volumetric flask, dil. to about 25 cc., add 1 drop phenolphthalein soln. and enough NH_4OH to make the soln. faintly pink. Then add 5 cc. 5% NH_4Cl dil. to the mark and mix. Pour into an Erlenmeyer flask contg. 0.65 g. finely powdered $MgCO_3$. Mg-

(OH)₂, shake for 1 min. and fill a filter made of a 9-cm. paper nearly to the top. Receive the filtrate in the same flask and then filter the entire mixt. into a dry container. This percolation through a mixt. of MgCO₃·Mg(OH)₂ and MgNH₄PO₄ effectively removes practically all the PO₄. If the urine is extremely dil., it is used without further diln., 0.25 g. solid NH₄Cl being used instead of the soln. *Inorganic sulfate*.—Pipet 5 cc. filtrate into a 100-cc. beaker. Add 2 drops 0.04% EtOH soln. of bromophenol blue, 5 cc. H₂O and then *N* HCl until the soln. is yellow without a trace of blue. Run in from a pipet 2 cc. of benzidine soln. prepd. by suspending 4 g. benzidine in 150 cc. H₂O in a 250-cc. volumetric flask, adding 50 cc. *N* HCl (accurate), shaking until dissolved and dil. to the mark. After 2 min. add 4 cc. 95% AcMe and let stand 10 min. more. Filter through a thin mat of filter pulp in a special filtration tube. (See sketch. The tubes are best made from Pyrex tubing 15 mm. internal diam., shrunk at one end so as to leave a hole 3 mm. in diam., cut to length of 70 mm. and flanged at the cut end.) Wash the beaker and filter with three 1-cc. portions and one 5-cc. portion 95% AcMe.



Transfer 2 cc. H₂O to the filtration tube and, with sharp nichrome wire, poke the filter into a 200 x 20-mm. Pyrex test-tube. Rinse the wire with a few drops H₂O and heat the contents of tube just to boiling, leaving the filtration tube suspended in the mouth of the test-tube. Add 2 drops 0.05% H₂O soln. of phenol red (as mono-Na salt) and run in from a microburet (*C. A.* 15, 1911), through the filtration tube, about 1 cc. 0.02 *N* NaOH. Rinse the filtration tube with 2 or 3 cc. H₂O, heat the contents of the test-tube to boiling and again rinse the filtration tube until the total vol. in the test-tube is about 10 cc. Remove the filtration tube and continue titration with 0.02 *N* NaOH until the color begins to change from yellow to red. Again heat to boiling and pour the hot liquid into the beaker in which pptn. took place and back again in order to decompose any trace of ppt. that may have adhered to the wall of the beaker. The addition of the alkali is continued, 0.02 cc. at a time, until the soln. acquires a definite pink color which further boiling does not discharge. 1 cc. 0.02 *N* NaOH = 0.32 mg. S. *Total sulfate*.—To 5 cc. of the filtrate from the Mg ppt. in a 100-cc. beaker add 1 cc. 3 *N* HCl. Heat on the H₂O-bath for 10 min. after it has become dry, add 10 cc. H₂O and rotate the beaker until the residue has disintegrated. Add 2 cc. benzidine soln. and proceed as in the detn. of inorg. SO₄. *Total S.*—To 0.25 cc. Benedict's reagent (*C. A.* 3, 2814) in a 6-cm. evapg. dish, add 5 cc. of the urine filtrate. Evap. to dryness, and heat gradually until red for 2 min. Cool, add 1 cc. 3 *N* HCl and evap. to dryness. Wash into a 100-cc. beaker with five 2-cc. portions H₂O. Add 1 drop *N* HCl and proceed as above except that the first washing should be with 2 cc. 50% AcMe instead of 1 cc. 95% AcMe. "For comparison the same urines were analyzed gravimetrically (Folin's method for inorg. and total SO₄, Benedict's method for total S). Differences greater than about 1% sometimes occur in the detn. of inorg. SO₄, especially when the S excretion is small, however closely duplicates by each method may agree. In such cases there is apparently no way of deciding which method is the more accurate. Discrepancies of this nature have not been observed in the detn. of total SO₄ or total S." I. GREENWALD

The theory and technic of the determination of the acidity of gastric contents. W. LANZ. *Arch. Verdauungs-krankh.* 27, 282-352(1921).—This is probably the most critical discussion of the problem of the detn. and significance of gastric acidity that has appeared for some time. The general conclusions are that the actual acidity is best detd. by the gas-chain method; however, for secretion poor in protein good results are given by the indicator series: methyl violet, dimethylamino-azobenzene, methyl red, *p*-nitrophenol, rosolic acid or neutral red, naphtholphthalein. Titration with phloro-

glucinol vanillin gives only approx. results. The "true" acidity, *s. g.*, the true base-combining power of the juice cannot be measured. Instead the "total acidity" or the "neutralizing power" is measured and is not much different in protein-poor juice from the "true" acidity. This detn. is made by titration with 0.1 *N* NaOH and phenolphthalein as indicator. The potential acidity cannot be directly measured but is obtained by subtracting the "actual" acidity from the "total" acidity. F. S. HAMMERT

Acidosis: Its determination by means of hydrogen-ion concentration. T. I. HILLS. *J. Michigan State Med. Soc.* 19, 169-70(1920); *Physiol. Abstracts* 5, 291.—Three cc. oxalated blood drawn by venous puncture is dialyzed in a collodion tube into 3 cc. 0.8% salt soln. for 19 mins.; 0.2 cc. of 0.01% phenolsulfonephthalein is added to the dialysate, which is then compared with a series of standard tubes. Normal blood varies from p_H 7.4 to 7.6, serum from 7.6 to 7.8, the difference being due, perhaps, to the fact that oxyhemoglobin is a feeble acid. p_H values below these limits indicate acidosis.

H. G.

Estimation of uric acid in blood by Folin's method. A. SAHNOVSKA AND I. SALSKII. *Russ. Physiol. J.* 2, 14-36(1919); *Physiol. Abstracts* 5, 463.—The following modifications of the original method are proposed: (1) A blue glass plate is used instead of a standard soln. of uric acid; the color has to be carefully chosen. (2) Phosphotungstic acid and the Na carbonate solns. are added in equal parts; this preserves the color unchanged for several hrs., and prevents the formation of a fine ppt. which, when the usual amts. of the reagents are used, makes the colorimetric detn. difficult. Phosphotungstic acid may be recovered and used again. (3) Mg-Ag urate is decomposed, not with H_2S , but with a weak soln. of HCl, which forms AgCl and liberates the uric acid. This method is as accurate as the original and easier.

H. G.

Estimation of proteins in urine. V. A. BOLOTOV. *Russ. Physiol. J.* 2, 37(1919); *Physiol. Abstracts* 5, 444.—Sulfosalicylic acid (20% was used) is found to be 8 times more sensitive as a reagent for the detection of proteins in urine than HNO_3 . Amts. of 0.0042% of proteins can be detd. with accuracy. This method is useful for clinical purposes.

H. G.

New method of hydrolyzing proteins and tissues in the cold. DOMENICO LO MONACO. *Arch. farm. sper.* 30, 97-102(1920).—When subjected to the action of Cl, Br, or $COCl_2$ vapor, all animals except those with a coriaceous or chitinous skin undergo mummification, previous removal of the viscera being unnecessary. Treatment in the cold with Cl or Br vapor produces hydrolysis of proteins and other changes capable of wide application. Thus, fresh foods, such as fish, game, seeds, etc., may be made to retain their fresh appearance and odor, the treated materials causing no ill-effects when eaten. After such treatment, fresh peas and beans germinate readily, giving, out of season, robust plants bearing flowers and fruit. Further, dried seeds exhibit increased growth after the treatment, and a similar result is obtained when hyacinths are grown in dil. Cl water. Analogous effects are obtained when seeds are sown in soil mixed with vegetable matter previously treated with Br or Cl; the inorg. constituents of the soil are also rendered sol. to a large extent by this treatment. Leather and cloth cuttings are rapidly reduced to a dense, sol. pasty mass by the halogen vapor.

J. C. S.

A microchemical reaction of pulmonary epithelial tissue. E. FAURÉ-FRÉMIET, J. DRAGONU AND (MLLÉ) DU VIVIER DE STRHEL. *Bull. soc. chim. biol.* 2, 106-70(1920).—The test depends on the treatment of the tissue with a reagent contg. CH_3O and CdCl₂. The presence of S in the tissues causes a deposit of CdS to be formed.

J. C. S.

Estimation of carbon monoxide in the blood, and determination of the maximum absorption of carbon monoxide by the blood. MAURICE NICLOUX. *Bull. soc. chim. biol.* 2, 171-9(1920).—The method and app. are described in detail. The CO is con-

verted into CO_2 by explosion with O_2 and estd. as such. Blood satd. with CO took up from 25.55 to 23.45 vols. %, and when submitted to the action of a mixt. of CO and 5% of N the percentage vol. of the former gas taken up by the blood was found to be from 23.5 to 21.5.

J. C. S.

Arrest of glycolysis (in blood) by a mixture of sodium fluoride and monopotassium phosphate. L. AMBARD. *Bull. soc. chim. biol.* 2, 202-3(1920).—A. advises the use of a mixt. of 1 pt. of NaF and 2 pts. of KH_2PO_4 in the proportion of 15 g. per l. of blood.

J. C. S.

Modifications of Bertrand's method for estimating very small quantities of sugar. L. AMBARD. *Bull. soc. chim. biol.* 2, 203-5(1920).—A. advises heating the sugar soln. with the Cu reagents in a centrifuge tube immersed in a water-bath. The pptd. Cu_2O is collected by centrifugalization, washed, and dissolved in the tube by adding the $\text{Fe}_2(\text{SO}_4)_3$ soln.

J. C. S.

Amylase; its estimation and the mechanism of its action. L. AMBARD. *Bull. soc. chim. biol.* 3, 51-65(1921).—Crude powdered starch removes amylase from soln. and keeps it fixed, in spite of repeated washing by the centrifuge. On the other hand, it gives up the ferment promptly to filtered starch or glycogen solns. contg. neutral salt; the latter process A. terms "défixation." It furnishes (1) a convenient method for estg. amylase (in saliva, blood, urine, etc.), and (2) important light on the theory of its action. It is shown that the whole (96-100%) of the ferment in a soln. can be removed by starch powder; for the purposes of estn., solid starch-ferment complex is mixed with filtered starch soln. contg. NaCl (to allow of defixation) and a phosphate mixt. (to ensure the optimum pH 6.60 for the action of the ferment). The mixt. is kept at 35° for a time, until not more than $1/10$ of the starch has been hydrolyzed; during this initial phase of the reaction the amt. of sugar formed is proportional to the time (that is, the rate of the reaction is const.). The ferment action is then stopped by addition of enough NaOH to overcome the buffer action of the phosphate, and the maltose formed is estd. by a modification of Bertrand's process (cf. preceding abst.). The method is evidently very accurate. As regards the theoretical aspect, A. could not establish whether solid starch requires salt for the fixation of amylase, because it could not be washed free from salt; salt added to washed starch increased the fixation by 1.5% only. The addition of salt, levulose, sucrose, maltose, glycerol, or inulin to the wash water makes no difference; the amylase remains fixed. $\text{Fe}(\text{OH})_3$ and $\text{Al}(\text{OH})_3$ alone simulate the action of glycogen and starch solns. by reducing the activity of the starch powder-amylase complex, but apparently not by removing any amylase; rather by forming a complex with the starch which partly inhibits the action of the ferment. Salt-free glycogen "défixes" only 4%, but on addition of salt 98%. The change of pH from 6.60 to 5.0, or to 8.04, had no effect on defixation, but caused in either case a fall of 40% in the hydrolysis. Of this 40% only 2.5% is due to destruction of the enzyme; the decreased hydrolysis is almost entirely due to a slower rate of enzyme action. These results confirm the hypothesis of Henri (*Z. Elektrochem.* 11, 790-3(1905); cf. also, for example, Bierry and Glaja, *Compt. rend.* 143, 300-2(1906)), that ferment action is preceded by the formation of a complex with the substrate, which formation requires the presence of electrolytes. A. does not, however, confirm the dependence of adsorption on pH . The phenomenon, first observed by Duclaux, that an increase in the concn. of a starch soln. beyond about 1% does not increase the rate of hydrolysis, seems to depend on the fact that at such a concn. practically all the ferment (98%) is already fixed and employed in hydrolysis.

J. C. S.

Estimation of urea by sodium hypobromite. L. AMBARD. *Bull. soc. chim. biol.* 2, 205-8(1920).—A discussion of the technic of this method. A method for removing O from the liberated gas is described.

J. C. S.

Sodium fluoride or citrate as anti-coagulant in estimating blood sugar. R. CLOGNE AND A. RICHAUD. *Bull. soc. chim. biol.* 3, 66-8(1921).—With citrate, blood glucolysis continues and after 24 hrs. scarcely any sugar is left, but when coagulation is prevented by NaF, satisfactory results are obtained, even after 4 days. J. C. S.

New method for the estimation of uric acid in blood. ALHKSANDER OBRACKI. *Przeglad. Lekarski, Krakau* 59, No. 4(1920).—Serum (20-50 cc.) is dild. with 4-14 times its vol. of water and freed from albumin by treatment with uranyl acetate soln. (1.5%, in vol. equal to that of the serum). The ppt. is filtered, dissolved in a warm mixt. of water (equal in vol. to the filtrate), and 0.5 N NaOH soln., re-pptd. with 0.5 N AcOH and filtered while hot. Uric acid is sepd. in the usual manner from the combined and concd. filtrates. J. C. S.

Estimation of uric acid in blood by Folin's method. I. A. ZALESKI AND (MISS) A. A. SACHNOVSKA. *Russ. Physiol. J.* 2, 14-35(1919).—Expts. have been made to test the accuracy of the results yielded by Folin's method (Folin and Macallum, *C. A.* 6, 2245; 7, 621; Folin and Denis, *C. A.* 7, 1028, 1523), which depends on comparison in a colorimeter of the intensities of the blue colorations obtained when the uric acid soln. to be tested and a standard uric acid soln. are treated with phosphotungstic acid in presence of an alkali. The authors suggest various modifications in the procedure. The Mg-Ag salt, in the form of which the uric acid is sepd. from the blood, is best decomposed, not by H₂S, but by HCl, the Ag chloride being then removed by filtration from the uric acid soln.; this alteration shortens the time required by the estn. very considerably. For detg. the intensity of the blue coloration obtained with the phosphotungstic reagent, use is made of blue glasses previously standardized with the help of uric acid solns. of known concns. The method admits of the estn. of the amt. of uric acid in 10 cc. of blood with an error of at most 0.05 mg. J. C. S.

Detection of blood in feces. P. N. VAN ECK. *Utrecht. Pharm. Weekblad* 58, 723-7(1921).—As pointed out in a previous paper (*C. A.* 14, 1692) the benzidine test is not specific for blood. Many substances, particularly peptone and certain albumins and their cleavage products, respond to the test. It has been found, however, that blood will respond after heating even to charring, while a temp. of 175° suffices to destroy this property in other substances. Of 300 samples 467 gave the benzidine test before heating, but after heating to 175° only 175 still responded. Albumin in feces can generally be detected by the biuret reaction. Usually, but not always, if the biuret test is positive the benzidine test is also positive. A sample which was positive to both reactions contained 2.7% N; another, negative to both, contained only 0.7% N. Spectroscopic methods are not sensitive enough to serve as a control of the benzidine test. JULIAN F. SMITH

Further improvement in the nephelometer-colorimeter (KOBEL, KLETT) 1. Colorimeter (U. S. pat. 1,373,708) 1.

C—BACTERIOLOGY

A. K. HALLS

Nutritional physiology of the iron bacterium. R. LIESKE. *Centr. Bakt. Parasitenk. II Abt.* 49, 413-5(1919); *Physiol. Abstracts* 5, 437.—The Fe bacterium, *Leptothrix ochracea*, was isolated by the use of Mn acetate agar and successfully cultivated on this medium. Peptone is unnecessary for its growth. Ions of Fe or Mn are necessary. H. G.

Influence of the reaction of media and of the presence of buffer salts on the metabolism of bacteria. C. G. L. WOLF. *Brit. J. Expt. Path.* 1, 288-309(1920).—Two % Na₂HPO₄ in glucose peptone inhibits or delays gas production by *Bacillus coli*, *B. welchii*, *B. sporogenes*, *B. histolyticus*, and *Vibrio septique*. The effect on the N

metabolism is not pronounced. In the case of the saccharolytic organisms, the acid production is increased in the presence of buffer salts. Na phosphate increases the potency and stability of the toxin formed by *V. septique*. K H phthalate and Na pyrophosphate were also examd. The latter salt has not been previously used for this purpose; it may change by acids either to the orthophosphate or to the disodium dihydrogen pyrophosphate; its buffer action probably depends on the latter change.

J. C. S.

Metabolism of thermophilic fungi. KURT NOACK. *Jahrb. wiss. Bot.* 59, 413-66 (1920).—The investigations were chiefly effected with *Thermoascus aurantiacus*. Examn. of the respiratory metabolism showed that those thermophilic fungi, which have a high rate of growth in comparison with other fungi, also have an increased metabolism which is not shown by those which grow more slowly. In relationship to temp., however, the respiratory energy remained lower than was to be expected. Detn. of the economic coeff. showed that dextrose, when the sole source of C nutriment, was decomposed to the extent of 55% in the fungus, while 45% was used in metabolic processes. This relationship corresponds with that observed with non-thermophilic fungi, and thus proves that none of the C is used directly for the production of heat. N. has shown previously that the vegetative portions of thermophilic fungi have different resistances towards cooling below the minimum temp. of growth (21-35°), and that a species dies the more rapidly as the temp. chosen is lower, the hyphae being most readily affected. At a const. sub-minimal temp., the respiration rapidly diminishes, but the respiratory quotient, $\text{CO}_2 : \text{O}_2$, remains unaffected by cooling. In contrast to *Aspergillus niger*, *Thermoascus* rapidly adapts itself to chemically different nutriments. Expts. in atm. poor in, or free from, O showed that the vegetative mycelium could endure complete withdrawal of O for 8 days; under these conditions growth ceases and the respiratory energy is greatly depressed. Re-admission of O causes a marked increase of the respiratory quotient. Respiration, however, is permanently depressed, and only increases through the growth of new hyphae; withdrawal of O causes rapid death of the latter.

J. C. S.

Pseudomonas polysaccharidarum (n. sp.): an organism which decomposes complex polysaccharides. A. EPSTEIN. *Bull. soc. bot. Genève* 11, II, 191-8 (1920).—The new species readily decomposes pectin substances, cellulose, and starch, in presence of air, but does not attack lignin substances. In presence of air it liquefies gelatin within 5 weeks; the resulting liquid is acid and contains amines but not indole.

J. S. C. I.

Non-toxicity of copper for mildew. G. AND MME G. VILLEDIEU. *Compt. rend.* 172, 335-6 (1921); cf. C. A. 15, 288.—It is shown that, in a soln. of NH_4 carbonate (1 in 10,000 or 1 in 8000), satd. with basic Cu carbonate, *Phytophthora infestans* grows and the conidia evolve zoospores, which in their turn continue to evolve and grow.

J. S. C. I.

Decomposition of cellulose by aerobic bacteria (GROENEWEGE) 23.

D—BOTANY

CARL L. ALSBERG

Glucose as a source of carbon for certain sweet potato storage-rot fungi. J. L. WEIMER AND L. L. HARTER. *Bur. of Plant Industry. J. Agr. Research* 21, 189-210 (1921).—Modified Czapek's culture solns. were prepd. to contain glucose in concns. from 0 to 60%. The following 8 fungi, which cause decay of sweet potatoes in storage, were grown at 28°: *Fusarium acuminatum*, *Dip' dia tubericola*, *Rhizopus tritici*, *Mucor racemosus*, *Sclerotium bataticola*, *Penicillium* sp., *Botrytis cinerea* and *Sphaeronema fimbriatum*. The wt. of mycelium was detd. by drying in a vacuum oven at 60°; the glucose content of the solns. was detd. by means of a Fric saccharimeter. The depres-

sion of the freezing point was detd. by a Beckman thermometer in a flask cooled by the evapn. of $(C_2H_5)_2O$ and the osmotic pressure then calcd. The changes in acidity (p_H values) were made a potentiometer according to Michaelis being used. Considerable variation in the amt. of glucose consumed by the different fungi at the same concn. was noted. The greatest glucose consumption was found in solns. of about 10% and decreased with the increase of concn. All but 2 of the fungi grew in solns. containing from 42 to 50% glucose. *Penicillium* sp. alone grew in 58% glucose soln. The different fungi produced varying amts. of dry mycelium at the same concn. and showed different concns. for the production of the maximum amt. of fungous material and dry wt. The "economic coefficient" of the different fungi varied. Three of the fungi had little influence on the H-ion concn., while 5 increased the acidity of the solns. All of the fungi grew in a soln. having a max. osmotic pressure varying from 81.33 to 101.46 atm. *Fusarium acuminatum* and *Mucor racemosus* increased the concn. and the other fungi generally decreased it. In general the decrease in osmotic concn. was not in proportion to sugar consumed; so that it is possible that compds. such as org. acids, C_2H_5OH , etc., were formed from the sugar, which would themselves influence the osmotic concn.

F. C. COOK

Respiration of sweet potato storage-rot fungi when grown on a nutrient solution. L. L. HARTER AND J. L. WEIMER. U. S. Dept. of Agr. *J. Agr. Research* **21**, 211-26 (1921).—The first 7 fungi mentioned in the preceding abstract were shown to be able to utilize definite amts. of glucose as detd. by the CO_2 given off. The fungi were grown in synthetic liquid media. The dry wts. of mycelium, the amts. of glucose remaining, the amts. of glucose reduced and the amts. of CO_2 formed are all recorded for the 7 fungi. The coeff. of respiration, economic coeff. and respiratory quotient are all discussed. Four of the fungi gave positive and 3 negative alcohol tests by the iodoform method. Not enough CO_2 was produced to account for all the sugar consumed and the formation of alcohol and acids is believed to take place. Three fungi viz., *Penicillium* sp., *Botrytis cinerea* and *Sclerotium bataticola* grew very slowly and produced a large amt. of dry material. They produced a little more than 2 g. of CO_2 per day and consumed nearly all the glucose. The reverse is true of the other organisms. The coeff. of respiration varied from 0.83 to 2.01 and the economic coeffs. from 3.86 to 22.86. The amt. of CO_2 produced does not necessarily correlate with the amt. of dry material formed or with the amt. of glucose reduced.

F. C. COOK

Chemistry of carbonic acid assimilation in light of new work. H. SCHROEDER. *Ber. botan. Ges.* **36**, 9-27 (1919); *Physiol. Abstracts* **5**, 380.—A lecture dealing critically with various views, especially those of Willstätter and Stoll, as to the chem. nature of photosynthetic C assimilation.

H. G.

Action of magnesium sulfate on the development of roots and stalks. E. CANALS. *Bull. soc. chim. biol.* **2**, 138-9 (1920); *Physiol. Abstracts* **5**, 338.— $MgSO_4$ is toxic for roots in quantities as low as 2/10,000. This concn., however, usually has a favorable action on the stems. Above 5/10,000 it becomes toxic for these as well.

H. G.

Coffee bean (*Daubentonia longifolia*) as a poisonous plant. C. D. MARSH AND A. B. CLAWSON. *J. Agr. Research* **20**, 507-13 (1920); *Analyst* **46**, 145.—This plant, sometimes named *Sesbania cavanillesii*, is a shrub belonging to the order Leguminosae, and occurs in the wild state over an area extending from Florida to Texas. In feeding expts. on sheep the smallest dose of the whole plant producing symptoms of poisoning was 0.006 lb. per cwt. of animal, and the minimum fatal dose was 0.11 lb. The seeds are more highly toxic than the leaves and seed pods, although the roasted seeds have been used as a substitute for coffee without deleterious effect. Various closely related plants have from time to time been described as poisonous. The toxic substance in the plant is excreted very slowly by animals, and poisoning may result from the repeated

administration of quantities below the toxic dose. The plant is poisonous to sheep, and probably goats, but no data are extant with regard to its effect on cattle and horses.

H. G.

Action of light and carbon dioxide on the mobility of green and colorless swarming cells. ELIZABETH BOLTA. *Jahrb. wiss. Botanik* 59, 287-325(1920); *Physiol. Abstracts* 5, 507.—There is a similarity between photokinesis and phototaxis. It was shown that absence of CO_2 caused a cessation of movement in a great number of green and colorless "swarming cells." The chief condition is the presence of free H-ions. The CO_2 could be substituted wholly or partly by other acids.

H. G.

Hormones in the plant kingdom. F. WEBER. *Naturw. Woch.* 19, 241-53(1920).—General.

H. G.

The mechanism of root pressure. J. H. PRIESTLEY. *New Phyt.* 19, 189-99(1920); *Physiol. Abstracts* 5, 434.—A theory of root pressure is outlined that is in accord with the facts and laws of physics and chemistry, and which harmonizes with botanical facts.

H. G.

Content of soluble carbohydrates in pinewood. S. SCHMIDT-NELSON. *Tekn. Ukeblad* 67, 354-5(1920).—Pinewood felled in the spring was finely rasped, and after extn. with ether was repeatedly extd. by alternate boiling with water or 0.3% AcOH and treatment with alc. By more than 20 successive extns. a yield of sol. matter was obtained equal to 12.04% of the original wood or 13.9% of the dry substance. In detns. of reducing sugar by Kjeldahl's method 1 g. of the dried ext., before inversion, reduced 0.1898 g. of Cu, and after inversion with 2% HCl it reduced 0.6165 g. of Cu. A substantially similar ext. was obtained from pinewood felled in the winter, but the yield in this case was only $\frac{1}{2}$ of that mentioned above. Pentosan detns. on the ext. indicated about 23% of xylose.

J. S. C. I.

Manganese in commonly grown legumes. J. S. JONES AND D. E. BULLIS. *J. Ind. Eng. Chem.* 13, 524-5(1921).—Mn was detd. in several species of legumes to be used in feeding expts. Av. amts. varying from 23 to 68 mg. per kg. of air-dried sample were found. Mn is most abundant in the leaves, and it is thought this supports the view that its function in plants is catalytic.

T. G. PHILLIPS

Air pollution by smoke. A. G. RUSTON. *J. Min. Agr.* 27, 69-77(1920); *Expt. Sta. Record* 44, 430-1.—The expts. were made at Leeds. The higher temp. and stronger draft in factory furnaces increase the ash and decrease the tar in soot. The solids in soot lessen both the intensity and duration of sunlight, and clog the stomata, particularly of conifers, with tar or oil. In the center of Leeds, free mineral acids in the soot may amount to as much as 80 lbs. per acre. The sulfur content of the leaves of trees is usually increased. Small quantities of H_2SO_4 are very injurious to soil bacteria and to vegetation, and rapidly deplete the supply of lime in the soil. In pastures the flora is changed, resulting in some cases in decreasing their feeding value to one-sixth of the original. The low lime content of the milk produced on these areas is important.

T. G. PHILLIPS

Iron accumulation and mobility in diseased cornstalks. G. N. HOFFER AND R. H. CARR. *Phytopathology* 10, 56(1920); *Expt. Sta. Record* 44, 541.—Accumulation of Fe and increased catalase and oxidase activity are correlated with root-rot infection and malnutrition. The conduction of water and elaborated foods is interfered with. In these portions of the stem the reaction is nearly neutral. The health and rate of growth of a young plant may be detd. by its ability to maintain an acidity high enough to keep the iron compds. mobile, as occurs in normal green plants.

T. G. PHILLIPS

The whorled milkweed (*Asclepias galioides*) as a poisonous plant. C. DWIGHT MARSH, A. B. CLAWSON, J. F. COUCH AND W. W. EGGLESTON. *U. S. Dept. Agr. Bull.* No. 800, 40 pp.(1920).—This weed, growing in Colorado, Utah, New Mexico and Ari-

zona, is poisonous to horses, cattle and sheep, causing congestion of the peripheral blood vessels and spasms. Incomplete chem. examn. shows the presence of toxic compds. some of which are glucosides. Traces of a non-toxic alkaloid are also present. No satisfactory medicinal remedy has been found.

T. C. PHILLIPS

Chlorophyll content and carbon dioxide assimilation in Alpine and lowland plants.

M. HENRICI. *Verhandl. Naturf. Ges. Basel* 30, 43-136(1919); *Expt. Sta. Record* 44, 132. —The leaves of certain meadow plants at high altitudes contain much less chlorophyll than the same species in the lowlands. Some exceptions are noted. Assimilation of CO_2 in the Alpine plants begins at a higher light intensity, but at a lower temp. than in the lowland plants. The relative amt. of assimilation at different elevations is a function of light intensity and temp.

T. C. PHILLIPS

Seventeenth report of the Woburn experimental fruit farm. S. U. PICKERING.

Woburn Expt. Fruit Farm Rept. 17, 89, 315-25(1920); *Expt. Sta. Record* 43, 29-30. —The deleterious effect of one plant on another seems to be general, and more marked in case of plants of the same kind. The toxic agent, which has not been identified, seems to be oxidized easily. Removal of the toxins from the soil by means of leaching with water has been found to result in greatly increased growth.

T. C. PHILLIPS

The silica content of the reed (HERIG) 23. Conductivity and atmospheric ionization in a confined space under conditions of constant temperature and illumination (STOPPEL) 3.

E—NUTRITION

PHILIP B. HAWK

NORMAL

Remarks on standards for normal basal metabolism. J. H. MEANS AND M. N. WOODWELL. *Mass. Gen. Hosp. Arch. Intern. Med.* 27, 608-19(1921). —The observed values for the basal metabolism in 39 normal, and 6 obese persons and in a number of patients with evidences of hyper- or hypothyroidism were compared with those calculated from the Du Bois height-weight chart (*C. A.* 10, 2101), from the Harris-Benedict prediction tables and by the formulas of Dreyer (*C. A.* 14, 3265). With normal men, all three gave about the same deviation, though this was slightly less with the Du Bois formula than with the others. With obese persons, the Harris-Benedict tables gave slightly the better results, but with all three methods the results were within what may be considered the normal variation. In patients with hypo- and hyperthyroidism, the deviations were 6% greater with the Harris-Benedict tables and 7% greater with the Dreyer formulas than with that of Du Bois. The Du Bois standards are about 1.8 calories greater than those used by Harris and Benedict (and by Dreyer), possibly due to the fact that the former are based chiefly on detns. of 1 hr. duration in the calorimeter, whereas the latter are compiled largely from the results of shorter expts. with the respiration app. The Du Bois method is recommended as simple, already in common use and at least as good as the others.

I. GREENWALD

Creatinuria. II. Arginine and cystine as precursors of creatine. E. G. GROSS AND H. STRENBÖCK. *Univ. Wis. J. Biol. Chem.* 47, 33-43(1921); cf. *C. A.* 13, 971. —"Arginine administered orally in sufficient amts. (0.15 g. per kg.) augments creatine excretion in the pig. Creatinuria induced by casein feeding appears to have its origin in large part in the formation of creatine from arginine, but the acidity of the H_2PO_4 split off no doubt also contributes to the creatinuria as a result of the stimulation of the endogenous metabolism. Cystine feeding causes creatinuria only when the H_2SO_4 formed by the oxidation of its S is left unneutralized; when neutralized the creatinuria promptly disappears. Neutralization of acidity does not prevent the creatinuria called forth by casein or arginine feeding." **III. The effect of thyroid feeding upon creatin-**

uria. E. G. GROSS AND H. STEENBOCK. Univ. Wis. *Ibid* 45-62.—“The feeding of sheep's thyroid to a pig on a N-free diet calls forth a marked stimulation of creatine formation. This is accentuated when creatine precursors from exogenous sources are available. It is suggested that creatine formation is primarily dependent upon the balance that obtains between the arginase and oxidative systems whereby arginine is destroyed. On these premises, arginine from exogenous sources is not metabolized into creatine in the same proportions as arginine from endogenous sources because this balance varies in different organs. Furthermore, it is suggested that the thyroid principle may be active in causing creatine formation by accelerating the oxidative system of arginine destruction at the expense of the effect of arginase and that in the thyroid mechanism is to be sought the variable responsible for the difference in reaction of men and women to protein feeding. Creatinuria is looked upon as the result of the accumulation of creatine up to and beyond the threshold of its excretion. Usually this is prevented by the prevalent rate of conversion of creatine into creatinine which appears to be an invariable reaction.”

I. GREENWALD

Basal metabolism of normal women. KATHARINE BLUNT AND MARIE DYE. Univ. Chicago. *J. Biol. Chem.* 47, 69-87(1921).—216 observations of the basal metabolism of 17 women, 14 of whom were observed during one or more menstrual cycles and 1 for 26 almost consecutive days. No definite change in metabolism was observed during menstruation. The daily variation for each subject ranged from 7.4 to 28.8%, average 13.2%. The average of the observed values on any one subject differed from those calcd. from the multiple prediction tables of Harris and Benedict (*C. A.* 13, 1221, 1722) by from 5.5% to -12.9%, av. -4.1%. Compared with the Du Bois standards, (*C. A.* 11, 2345) the observed values are all low, from 0.3 to -13.8%, av. -6.5%. Except for one day in one subject in whom the pulse rate increased to an extent that may be considered pathological, there was no definite relation between pulse rate and level of metabolism. Neither was there any constant change in pulse rate during menstruation.

I. GREENWALD

Fat-soluble vitamin. VII. The fat-soluble vitamin and yellow pigmentation in animal fats with some observations on its stability to saponification. H. STEENBOCK, MARIANA T. SELL AND MARY V. BUELL. Univ. Wis. *J. Biol. Chem.* 47, 89-109(1921).—Codliver oil contains much fat-sol. vitamin but very little yellow pigment. Neither does the vitamin content closely parallel the pigment content in beef fat nor in butter fat but, owing to the fact that both factors are closely associated in the food supply, the most highly pigmented beef and butter fats are generally richest in vitamin. The fat-sol. vitamin is not destroyed by treatment with 2 cc. 20% KOH in EtOH for each gram of fat for 4 hrs. at 37° or for 30 min. at boiling temp. Cf. Steenbock and Boutwell, *C. A.* 14, 560, 1382, 1351.

I. GREENWALD

Supplementary protein values in foods. I. The nutritive values of animal tissues. E. V. MCCOLLUM, NINA SIMMONDS AND H. T. PARSONS. Johns Hopkins Univ. *J. Biol. Chem.* 47, 111-37(1921). II. Supplementary dietary relations between animal tissues and cereal and legume seeds. *Ibid* 139-73. III. The supplementary dietary relations between the proteins of the cereal grains and the potato. *Ibid* 175-206. IV. The supplementary relations of cereal grain with cereal grain; legume seed with legume seed; and cereal grain with respect to improvement in the quality of their proteins. *Ibid* 207-34. V. Supplementary relations of the proteins of milk for those of cereals and of milk for those of legume seeds. *Ibid* 235-47.—These papers report the results of expts. upon rats designed to det. in what manner the different kinds of food materials may compensate for individual deficiencies, particularly with regard to the biol. value of the protein. For such comparisons, the rate of growth is not a sufficiently accurate index. McC., S. and P. also observe the changes in the character of

the coat, the attention given this by the animal, the appearance of the skin of the ear, feet and tail, the habits of the animal when left alone or when handled, irritability or lack of this, fertility, success of female in rearing young (failure is apparently not due so much to lack of milk as to its poor quality and to the loss of normal reactions to the presence of the young on the part of the mother), fertility in succeeding generations (up to the fifth), etc. The kidney, liver and muscle of the ox contain proteins which, when these tissues are employed singly as the sole source of N, but completely supplemented with respect to all other factors, have about the same biological value as the proteins of the wheat kernel, although the kidney protein appears to have slightly the higher value. There is no distinct evidence of toxicity in muscle, kidney or liver when fed in amts. sufficient to secure from 35 to 70% of protein in the diet. The first limiting factor in all three tissues is lack of Ca. The addition of NaCl is also necessary. Liver and kidney contain an abundance of fat-sol. A and of H₂O-sol. B, and when fresh and raw, of H₂O-sol. C. Muscle tissue is very deficient in these factors but does not entirely lack any one of them. Although not superior to the cereal proteins when fed alone, the proteins of kidney, liver and muscle are remarkably effective as supplements for the proteins of cereals. They are all about equally effective as supplements to wheat protein. With mixts. containing 0.67 seed protein and 0.33 tissue protein, the relative order of decreasing effectiveness of the different seed proteins was: with kidney; wheat, barley, rye, oat, maize, soy bean, pea, navy bean: with muscle; wheat, oat, barley, maize, pea, navy bean, soy bean: with liver; barley, rye, wheat, oat, maize. The N compds. of the potato enhance to some degree the biol. value of the proteins of the cereal and legume seeds but not to so great an extent as do the proteins of muscle, liver, kidney or of milk. Neither is there any such selective efficiency in compensating for the deficiencies of individual seeds as is observed in the case of the animal proteins. The potato seems about equally effective as a supplement for all the seeds which have been studied. The combination of 2 cereal grains or of 2 legume seeds does not appear to offer a protein ration superior to that obtained from either seed alone. But the protein of a combination of a cereal grain and a legume, as with wheat and navy beans, or wheat and peas, may be decidedly superior to that of either alone. The proteins of muscle, liver or kidney are superior to milk for the specific purpose of supplementing the proteins of the cereals, barley, rye, maize, wheat, rolled oats and the legumes, peas, soy beans, navy beans and the potato. Milk, however, is an effective supplement for these vegetable foods with respect to other factors as well as protein. This is especially true of Ca and fat-sol. A. (Liver and kidney will also supply fat-sol. A. Abstr.). I. G.

The sensitivity to poisons of those suffering from vitamine deficiency. W. STORM VAN LEEUWEN AND F. VERZAR. *Verslag. Akad. Wetenschappen Amsterdam* 29, 654-8 (1920).—When fowls and cats were fed on polished rice and food deficient in vitamins, the organs did not show any change in sensitivity towards adrenaline, histamine, choline, and atropine. In two expts. it appeared that atropine did not remain in the intestine of fowls suffering from vitamine deficiency after receiving that drug in doses of 0.001 to 1 mg. daily. These fowls made weak spontaneous movements. It appears that there is no stimulating effect of atropine in the intestines of fowls fed on polished rice.

N. KOPPELOFF

Partial pancreatectomy. Experimental chronic pancreatic diabetes. E. LANGFELDT. *Acta med. Scand.* 53, 1-191 (1920); *Physiol. Abstracts* 5, 302-3.—A detailed study of the carbohydrate metabolism of dogs from which the greater part of the pancreas had been removed in order to imitate the conditions obtained in human pancreatic diabetes. In young animals variations of carbohydrate tolerance were found to follow the operation, but the typical symptoms of diabetes did not appear for several months. On the other hand, a full-grown animal became glucosuric at once on removal of most of

the pancreas. L. arrives at the conclusion that the pancreas influences the rate at which sugar is taken up from the blood by the tissues, not the rate at which it is oxidized. The differences between the clinical picture presented by these animals and that of human diabetes are due to a great extent to the absence of the alk. pancreatic juice from the duodenum under the exptl. conditions. The acid gastric contents liberate substances from the duodenal walls which, by stimulating the liver, lead to hyperglucemia. There was no evidence post mortem that any of the endocrine organs, other than the islets of Langerhans, had played any essential part in the production of the observed symptom complex.

H. G.

Protein metabolism with special reference to mixtures rich in carbohydrate. M. RUBNER. *Arch. (f. Anat.) u. Phys.* 1919, 24-72; *Physiol. Abstracts* 5, 362.—This gives the importance of the addition of carbohydrates and fats for the diminution of protein metabolism. Tables of series of expts. with various food combinations are given.

H. G.

Hindhede's investigations on the protein minimum of a bread diet. M. RUBNER. *Arch. (f. Anat.) u. Phys.* 1919, 124-42; *Physiol. Abstracts* 5, 360.—Refutation of the views of Hindhede (cf. *C. A.* 8, 3577).

H. G.

Ration of the Belgian soldier in the field. F. DE BLOCK. *Arch. méd. belges* 73, 509-34 (1920); *Physiol. Abstracts* 5, 415.—A useful summary, mainly statistical, of the food of Belgian soldiers from 1914-19. The ration contained 100-110 g. protein, 90-100 fat, and 500 carbohydrate, and had a calorie value of 3,300-3,700, rising to 4,000 during severe efforts. Alc. in moderate doses was found most useful.

H. G.

Alimentation by various bread-making flours. C. ACHARD AND L. GAILLARD. *Arch. méd. exp.* 28, 644-56 (1920); *Physiol. Abstracts* 5, 472.—To a basal diet of carrots, etc., in rabbits, flour from wheat, maize, rice, etc., was added. Details are given of the weight, growth, etc., and the weights, etc., of various organs at the autopsy. They hesitate to apply their results to human beings, as the latter take such cereals as bread, or cooked in some way, not as the raw flour. As, however, their chief conclusion is that there are no marked differences in the use of the six flours they used, this want of practical application is not serious.

H. G.

The quantitative relation between the antineuritic value of a diet and the onset of polyneuritis. H. H. GREEN. *Fifth and Sixth Reports of Director of Vet. Res., Union of S. Africa, Dept. of Agr.* April 1918; *Physiol. Abstracts* 5, 305-6; cf. *C. A.* 12, 2599.—Many expts. on pigeons show that the daily demand for the vitamine B is not definite, but varies with the exogenous metabolism. There appears to be no reason to think that vitamine consumption is related to carbohydrate metabolism any more than that of fat or protein. Vitamine B is also required for tissue building. The term "vitamine index" is used to denote the ratio of vitamine absorbed in digestion to the energy value of the digested food. A formula is deduced to deal with this theory.

H. G.

Avitaminosis and testis. P. NOVARO. *Gaz. degli ospedali, Milan* 41, 424 (1920); *Physiol. Abstracts* 5, 473.—Pigeons on a diet without water-sol. vitamine B exhibited degeneration of the tubules and hyperplasia of the interstitial tissue in the testis.

H. G.

Influence of carbohydrates and fats on nitrogen equilibrium. A. KRAFT. *Illinois Med. J.* 37, 255-7 (1920); *Physiol. Abstracts* 5, 309.—The administration of fat and starch reduced the rate of loss of body wt. in underfed dogs.

H. G.

The vitamine content of extract of rice bran, and the methods of estimating it. B. C. P. JANSEN. *Med. geneesk. lab. Wellesreden, Java* 1920, 3e Ser. A, Nos. 1, 2, 3, 22-40; *Physiol. Abstracts* 5, 361.—0.3% HCl, 70% alc. and 96% alc. contg. HCl were used to ext. rice bran. The exts. were dried on to washed white rice, and the resultant product was given to cocks and doves. The diff. methods of extn. all gave the same result, and the vitamine is quantitatively extd. Doves are slightly more susceptible than

cocks to lack of antineuritic vitamine. Chem. methods for estg. vitamines are not yet trustworthy; the biol. method is the only safe one at present. "Nonnetjes" (*Munia maja*) are more susceptible than the other birds used; therefore they are suitable animals for estg. antineuritic vitamine.

H. G.

The digestion of fishes. A. F. SVOLIMA. *Russ. Physiol. J.* 2, 170-84(1919); *Physiol. Abstracts* 5, 469.—The expts. were performed on sharks (*Scyllium catalis*) with gastric or intestinal fistulas. After feeding the fish, the acidity of its gastric juice gradually increases up to a certain max., which is reached in about 48 hrs. The maximal acidity is about 1.6% calcd. as HCl. The proteolytic enzyme of the gastric juice splits the proteins down to cryst. products, so that about 62% of the N are not precipitable by phosphotungstic acid. The period of digestion is very long (up to 5 days). Lipase is absent in the gastric juice of the shark. Contrary to Van Slyke's and White's expts., (cf. *C. A.* 5, 1955) no absorption of foodstuffs and N could be observed in the stomach.

H. G.

The influence of the anterior lobe of the hypophysis upon the development of the albino rat. WARREN R. Sisson and EDWIN N. BROYLES. *Johns Hopkins Univ. Bull. Johns Hopkins Hosp.* 32, 22-30(1921).—"The desiccated powder of the anterior lobe of the hypophysis gland of young calves in doses of 0.04-0.3 g. was fed to albino rats (*Mus norvegicus albinus*) of a standard stock. The expts. were begun when the animals were 3 weeks old and lasted for periods of from 7-10 weeks. 68 animals were used for the expts., about 1/2 being controls. These animals were observed for differences in activity, in the condition of their fur, in their nutrition and in their skeletal development. Special emphasis was laid upon differences in external sexual characteristics, changes in body wts. and differences in the microscopical findings of the reproductive organs and the endocrine glands. Dietary precautions were taken in order to differentiate the effect of food and the gland substance. The hypophysis-fed animals developed normally and showed no differences beyond the variations of their species. The autopsy studies also show no differences." The results of the expts. are in agreement with the findings of Gudernatsch (*C. A.* 9, 1931), Lewis and Miller (*C. A.* 7, 3999), and Hoskins (*J. Exptl. Zool.* 21, 295) and at variance with those of Clark (*C. A.* 9, 3281), Robertson (*C. A.* 10, 1666) and Goetsch (*C. A.* 10, 919) who observed an acceleration of growth after feeding the gland.

A. P. LOTHEROP

The variation and the statistical constants of basal metabolism in men. J. ARTHUR HARRIS and F. G. BENEDICT. *Carnegie Inst. of Wash. J. Biol. Chem.* 46, 257-79 (1921).—"The avs. of daily periods of observation for individual men who have been studied from 20 to 53 days show statistically significant ranges and standard deviations of metabolism, the magnitudes of which depend upon the unit of measurement. When the variabilities are expressed as percentages of the means to show their relative values it appears that the variability is measured by coeffs. of variation of about 4% of the av. metabolism. The variability in the metabolism of the individual is positively correlated with the duration of the period of time over which the observations have been distributed. This indicates not merely that the metabolism of the individual under the standard conditions for basal detns. is variable but that the amt. of variation bears a measurable relation to the length of time over which the observations extend. The correlations between range of observations and variations in metabolism are greater for narrower ranges of observation than for longer ranges, thus indicating that the greater part of the physiological variations in metabolism will be realized in relatively short periods of time. It is evident, therefore, that the metabolism of the 'normal' subject is not const. even with practically const. body mass but is to some extent in a state of flux. The consts. given furnish some measure of this variation and may serve as a basis of comparison in future work. The statistical problem concerning the population

const. consists in detg. (a) whether the individual means or the individual minima (of daily means) shall be used as the basis of calcn., and (b) what method of weighting, if any, shall be adopted when repeated observations have been made in varying numbers upon the individuals of a series. Analysis of the 863 daily means available for 136 men studied at the Nutrition Lab. shows that in this series the means deduced by weighting do not materially differ from those detd. without weighting. The results of this study also show that the population const. derived from individual means is less modified by weighting than that deduced from the individual minima. Furthermore, both standard deviation and coeff. of variation are lower when the population const. are based on individual means or upon all daily means than when based on individual minima. Since weighting may logically be demanded, it is clear that the method of means furnishes a more suitable const. for representing the metabolism of a series of individuals than the method of minima. The method of weighting adopted will depend to some extent upon the personal judgment of the investigator. Weighting with the actual number of days probably attaches relatively too great importance to the observations on certain individuals who happen for one reason or another to be more extensively studied. Probably weighting with the square root of the number of days rather than with the number of days would be the course recommended by most statisticians."

A. P. LOTHROP

Amino acids in nutrition. III. Is proline a growth-limiting factor in the proteins of peas (*Vicia sativa*)? What nucleus in zein is responsible for supplementing these proteins? BARNETT SURE. Univs. Wis. and Ark. *J. Biol. Chem.* 46, 443-52(1921); cf. C. A. 14, 3706.—Zein supplements the proteins of peas to a considerable extent but neither lactalbumin nor gelatin are efficient (confirmation of the findings of McCollum, Simmonds and Parsons, C. A. 13, 1489). In addition neither arachin (peanut globulin) nor edestin improve the nutritive value of pea proteins. Several of the known amino-acid constituents of zein and other amino acids as well were added to a ration containing 45% of peas in an effort to det. the nucleus responsible for the supplementing effect of zein. Alanine, leucine, valine, tryptophan, lysine, cystine, tyrosine and proline were eliminated and "since zein is very low in arginine and histidine, it is suggested that zein may contain one or more amino acids necessary for growth as yet not isolated by previous methods of technic."

A. P. LOTHROP

A study of the chlorine content of milk and blood after the ingestion of sodium chloride. W. DENIS AND WARREN R. Sisson. Mass. General Hosp. *J. Biol. Chem.* 46, 483-92(1921).—"A series of expts. were carried out to det. the effect of diet upon the Cl concn. of milk. On a salt-free diet for a period of 24 days no change took place in the Cl concn. of milk from a goat giving about 150 cc. per day; the ingestion of 1.2 g. per kg. of body wt., daily, over a period of 6 days causes no change in Cl concn. of the milk. Further expts. were undertaken with goats to show the effect of increasing the Cl concn. of the blood plasma upon the Cl content of the milk. By administration of an amt. of NaCl sufficiently large to produce an 18% increase in the concn. of this salt in the blood plasma, the Cl content of the milk is also raised. Coincident with this increase in the Cl concn. of the milk and blood plasma the vol. of milk became greatly diminished." It has previously been shown that ingestion of moderate amts. of NaCl has no effect on the output of Cl in either human or cow milk.

A. P. LOTHROP

Animal utilization of xylose. ELBERT W. ROCKWOOD AND KRIKOR G. KHOROZIAN. Univ. Iowa. *J. Biol. Chem.* 46, 553-8(1921).—Xylose was fed to rabbits, cats, dogs and man in diets furnishing varying amts. of other carbohydrates and of protein. More xylose was utilized on a diet containing little or no other carbohydrate but the amt. absorbed was very small at best and it cannot be regarded in any sense as a valuable food. Utilization was greatest in the rabbits (1.5-1.75 g. per kg. of body wt.) and much

less in cats and dogs (0.5–1.0 g.). In man the amt. was very small in proportion to the body wt. varying from 0.145 g. on a low carbohydrate diet to 0.068 g. on a high carbohydrate diet. In estg. the utilization of xylose the difference in the amt. ingested and that excreted in the urine and feces was detd. and no opinion is expressed as to whether that which disappeared was oxidized, stored or converted into some other compd.

A. P. LOTHROP

The relation of plant carotinoids to growth and reproduction of albino rats. LIAOV S. PALMER AND CORNELIA KENNEDY. Univ. Minn. *J. Biol. Chem.* **46**, 559–77 (1921).—Normal growth and reproduction has been observed in albino rats, a species of animal in which there is a complete absence of carotinoid pigments, with ewe milk-fat and carotinoid-free egg yolk as the sole sources of fat-sol. vitamins. The ewe milk-fat contained only 0.00014% of carotin and the ration showing the best results contained only 0.0000126% of carotin. The carotinoid-free eggs were obtained from hens remaining from an original carotinoid-free flock of white Leghorn fowls raised from hatching to maturity and continuously thereafter on rations containing at most mere traces of carotinoids (*C. A.* **13**, 3215). The basal ration used was entirely devoid of carotinoids. A quant. comparison of the carotin content and vitamin efficiency of various rations shows wide and incongruous relations between the two factors. The substances are not even quantitatively associated in the plant tissues in which both are presumably synthesized. The results of the expts. show conclusively that carotinoid pigment is not necessary for the normal growth and reproduction of albino rats and indicate that the fat-sol. vitamins and carotinoid pigment are not identical.

A. P. LOTHROP

Organic foodstuffs with specific action. IV. Gas metabolism changes in pigeons fed upon polished rice, with and without the addition of yeast to the diet. EMU ABDERHALDEN. *Arch. ges. Physiol.* **187**, 80–9 (1921).—Pigeons were fed for 2 weeks on a diet consisting exclusively of polished rice and at the end of this period they presented the characteristic manifestations of alimentary dystrophy. During the period of the expt. body wt., temp. and gas metabolism detns. were made and curves plotted for the values secured show a gradual fall throughout the course of the expt. When yeast, or an alc. ext. of yeast, was added to the diet a rise in the gas metabolism always occurred.

G. H. S.

Physiology of the liver. III. Glycogen feeding. P. JUNKERSBORG. *Arch. ges. Physiol.* **187**, 260–82 (1921); cf. *C. A.* **15**, 1923.—The excessive addition of protein and carbohydrate to the food of dogs results in a very considerable accumulation of glycogen in the liver. In certain animals a high glycogen content corresponds with a high liver wt.; but in any series of animals no const. proportion between these factors is present. Glycogen content and fat content stand in inverse ratio. A liver with high glycogen content shows a water content which is lower than normal. High-protein and carbohydrate diet may lead to a marked increase in the wt. of the liver; in one expt. the liver weighed 12.43% of the body wt. Individual variations in the wt. of the liver as compared with body wt., and in the relationship between the glycogen, fat and water in the liver become very pronounced after glycogen feeding.

G. H. S.

Therapeutic use of sugar in infants. P. NOBECOURT. *Bull. acad. m d.* **85**, 224 (1921).—Of the sugars, only sucrose is of therapeutic value, and when employed in amts. of 10–15 g. per 100 g. of food it is very useful in diverse conditions, such as persistent vomiting, hypotrophic and cachectic conditions, acute and subacute gastrointestinal disturbances, etc. Elimination of sugar from the diet often leads to serious pathologic conditions.

G. H. S.

Absorption and elimination of hot and cold sugared drinks. BIOGV. *Bull. acad. m d.* **85**, 233–5 (1921).—Two expts. 10 days apart, were conducted upon the same 4 individuals under identical conditions. In the first test each of the men drank 600

cc. of cold water, containing 5% of sugar and 0.1 g. of methylene blue, after having walked a distance of 13 km. The methylene blue first appeared in the urine after 28–37 min. The blood pressure rose, within 15–17 min. after the ingestion of the fluid, from 13–14 to 14–15 cm. of Hg. The second test differed from the first only in that the fluid was warmed to 38°. Methylene blue first appeared in the urine after 14–18 min. A change in blood pressure occurred after 7 min. It is concluded that hot fluids are absorbed more quickly than cold drinks. G. H. S.

Nutritive value of infant foods. DOLÉRIS. *Bull. acad. méd.* 85, 360–5(1921).—Com. preps. offered for use as "complete foods" are not "complete." The exact compn. of such preps. should be indicated upon the labels and use of the word "complete" should not be allowed. These conclusions are based upon exptl. data. G. H. S.

Pathogenic significance of fatty acids in fat-milk feeding. RIETSCHEL. *Z. Kinderheilk.* 28, 183–200(1921).—The amt. of fatty acids in fresh milk is very small, and even in acid milk which has undergone bacterial fermentation the amt. is not considerable. The formation of fatty acids from the milk does not appear to have any pathogenic significance under any conditions. Clinical observations warrant the conclusion that the harmful action of cow milk is due to pathologic conditions in the intestine rather than to any preformed fatty acids in the milk. G. H. S.

The state of nourishment and infection. E. WERTHEIMER AND E. WOLFF. *Z. Kinderheilk.* 28, 295–309(1921).—The incidence of infection, the duration of the infections, and the mortality rates were analyzed in several groups of children. Striking differences were found, all in favor of the adequately nourished children. The authors reason that since antibody formation is a function of the cell, any condition, such as undernourishment, which tends to impair the activity of the cell will be reflected in a decreased resistance of the body to infection. G. H. S.

Sugar tolerance in the new-born. PAULINE FELDMANN. *Z. Kinderheilk.* 28, 325–8(1921).—The sugar tolerance of 100 male infants was detd. during the first few days of life. The tolerance limit for beet sugar was 7.2 g. per day and kg. of body wt. when given 17 g. of the sugar to 100 g. of cow milk. G. H. S.

ABNORMAL

Effect of Röntgen-ray treatment of the adrenals upon the metabolism in diabetes. H. BEUMER. *Z. Kinderheilk.* 28, 329–34(1921).—Röntgen-ray treatment of the adrenals in a diabetic caused a rapid decrease in the blood sugar; from 0.262% to 0.122%. The condition of acidosis also was changed but the elimination of sugar in the urine was not influenced, nor was the carbohydrate tolerance altered. G. H. S.

Barlow's disease: Effect of heat on the vitamine: The question of the concentration of the food. EDMUND NOBEL. *Z. Kinderheilk.* 28, 348–70(1921).—Seven children were cured of Barlow's disease by feeding them exclusively upon milk. In 5 of the cases the milk was heated for 10–35 min., and in 2 cases the heating was prolonged to 1 hr. It is concluded that the vitamine is not as thermostable as has been assumed. The concn. of the food, i. e., the water content, is important. G. H. S.

Osteomalacia: A study of the effects of certain organ extracts and oöphorectomy on the metabolism of calcium and magnesium. H. A. FREUND AND B. C. LOCKWOOD. *Ann. Med.* (Hagerstown, Md.) 1, 67–76(1920); *Physiol Abstracts* 6, 74.—The patient was a woman 33 yrs. of age. After a week's control period she was given successively desiccated thyroid in 5 grain doses 3 times daily; pituitrin, 1 cc. hypodermically twice daily; and, finally, parathyroid ext. in $\frac{1}{10}$ grain doses, frequency not stated. In each case the gland administration was continued for a week, with rest periods between. Succeeding the parathyroid administration the ovaries were removed, both being cystic. During each period of the study, detns. were made of the Ca and Mg intake and output

There was a marked Ca loss and a minute Mg loss. Most of the Ca was excreted in the urine. During the thyroid administration there was a negative Ca balance of 1.447 g. as compared with 0.447 during the control period. During the same period there was a negative Mg balance of 0.327 g. as compared with 0.027. During the pituitrin period the Ca balance was -2.604, and the Mg balance -0.015. There was thus augmented Ca loss during both the thyroid and the pituitrin periods. The Mg loss was more than 10 times as great during the thyroid as during the normal period. During the pituitrin period there was little change in Mg excretion. During the parathyroid period, on the other hand, there was a marked gain both in Ca and Mg, the balances being positive, 0.616 and 0.775 g., resp. After removal of the ovaries there was much greater loss of Ca than during any preceding period. The negative balance for Ca was 5.086, and for Mg 0.291. The castration was not successful in arresting the disease, as is shown both by these figures and by the clinical condition of the patient a year later. H. G.

War diet and diabetes. C. v. NOORDEN. *Med. Klin.* 1921, No. 1, 5-7; *Physiol. Abstracts* 6, 51-2.—The advantageous influence of nutrition during the war on the metabolism of many diabetic patients was caused by the diminution of protein and by the cessation of over-nutrition. H. G.

Pathological changes in gaseous metabolism at rest. MARIE KROGH. *Ugesk. f. Læger* 82, 539-50, 577-82(1920); *Physiol. Abstracts* 5, 300.—The app. used is fully described, and by it the normal gaseous metabolism of the body at rest was detd. Departures from this occur in disease, and diseases of the thyroid were specially studied; the metabolism goes up in Graves' disease, and falls in myxedema; this is regarded as so typical that by this method the diagnosis may be regarded as certain; by dosing myxedematous patients with thyroid the metabolism rises, and the dose necessary may be ascertained by noting the return of metabolism to normal; too large doses may produce a too great rise and symptoms of hyperthyroidism. H. G.

F—PHYSIOLOGY

ANDREW HUNTER

Histological investigations of oxidases. G. MARINESCO. *Compt. rend. soc. biol.* 82, 98-102(1919).—The technic of Graff and v. Gierke was used. The topography of the gray tissue was made clearly manifest in the central nervous system and peripheral ganglia. The oxidase reaction was positive in all the glands examd. (thyroid, liver, pancreas, spleen, kidney, etc.). The intensity of the reaction varied in different groups of animals; in mammals, and especially in birds, it was much more distinct than in cold-blooded animals. In the frog the reaction was distinctly positive in the cardiac muscle and only slightly positive in other striated muscles during the cold season.

H. S. PAINE

Function of the protein in the lacrimal secretion. C. F. CHARLTON. *Am. J. Ophth.* [3] 3, 802-4(1920); *Physiol. Abstracts* 5, 459.—Evidence is adduced to show that the protein in tears regulates the proper interchange of fluid in the cornea. Absence or impairment of the normal film over the cornea favors pathol. changes. H. G.

Preformed enzymes in blood. A. ALBANESE. *Arch. ital. di chir.* 1, 711(1920); *Physiol. Abstracts* 5, 291-2.—Proteolytic enzymes are present in the blood, and their action is the more energetic the less the degree of affinity between the animals used. For example, guinea-pig serum has no action on guinea-pig muscle or nerve but digests those of the dog. Rabbit serum acts powerfully on dog nerve, and less strongly on guinea-pig nerve; dog serum digests the muscular and nervous tissue of both rodents, and so forth. H. G.

The respiratory quotient of birds fed on polished rice. B. C. P. JANSEN AND R. M. M. MANGKOWINOTO. *Med. genesk. lab. Weltevreden (Java)* 1920, 3e Ser. A.

Nos. 1, 2, 3, 50-65; *Physiol. Abstracts* 5, 361.—The respiratory quotient was studied with the hope that the fall in respiratory quotient might be made use of in testing foods for antineuritic vitamin. The respiratory quotient did fall in one or two cases, but the fall is not const. and cannot be used in the diagnosis of polyneuritis. H. G.

Choline as hormone of intestinal movement. R. MAGNUS. *Naturwissenschaften* 1920, No. 20, reprint, pp. 6; *Physiol. Abstracts* 5, 415.—After a general account of intestinal movement, M. goes on to allude to the work of le Heux, (cf. C. A. 14, 1714) who regards choline on exptl. evidence as the main chem. stimulus of Auerbach's plexus, and fully endorses this view. The origin of choline is the lecithin of protoplasmic cells; its activity is controlled by some antagonistic substance with the same action as atropine, and may be intensified by the formation of certain esters as in acetylation (Dale, Reid Hunt). If this occurs in the intestine the presence of synthetic enzymes capable of forming choline esters is postulated. It is possible that choline may play a similar role in other organs. H. G.

Substances similar to adrenaline in blood serum. J. R. F. RASSERS. *Nederlandsch Tijdschrift voor Geneeskunde* 64, 785-91 (1920); *Physiol. Abstracts* 5, 367.—By means of expts. on unstriated muscle from several sources (intestine, artery, uterus) it was shown that the alc. ext. of serum, dialyzed serum, and also the dialysate, contain constrictor substances. H. G.

Influence of the alkaline earth ions on the radiocative equilibrium as shown by the potassium-uranium lines (K-U) lines. H. C. A. DETMAR. *Onderzoek. uit het Physiol. Lab. Univ. Utrecht* [6] 1, p. 1 (1920); *Physiol. Abstracts* 5, 441.—D. has made researches on the influence of Ca, Sr, Ba, and Mg on the equil. lines of K-U. The test object was the heart of the frog, perfused by Kronecker's cannula. Augmentation of Ca in the perfusion fluid causes a displacement of the K-U lines; Ca has a balancing power on both of these constituents, but stronger on the UO_2 -ions, so that more $UO_2(NO_3)_2$ is wanted to keep up the equil. Sr has the same influence on radioactive equil. as Ca, and can entirely replace the Ca-ion. Ba has also an influence on the K-U equil., because when a small dose of a Ba salt is added to a perfusion fluid in which an equil. has been established this equil. is disturbed and can only be regained by increase of the UO_2 -quantity. It acts much more strongly than Ca and Sr. Mg has no influence on the K-U equil. Zwaardemaker has shown that fluorescein displaces a K-U equil. so that more K is needed to re-establish it; he thinks that fluorescein sensibilizes the muscle cells of the heart for K. Detmar has found that fluorescein has the same action in presence of Sr and Ba in the perfusion fluid. H. G.

Biochemical experiments on normal and frightened animals. V. M. BUSCAINO. *Rivista patol. nervosa mentale* (Firenze) 24, 400-3 (1920); *Physiol. Abstracts* 5, 367.—Frightened guinea pigs and cats become glucosuric, and the oxidizing power of their blood serum rises. Differences of staining reactions from the normal in the central nervous system are described, so also are vascular congestion and histological changes in liver, adrenal cortex, thyroid, interstitial cells of ovary and testis, etc. H. G.

The excitable substance of the nerve cells. A. DANILEVSKII. *Russ. Physiol. J.* 2, 128-44 (1919); *Physiol. Abstracts* 5, 458.—Neuroglobulin and neurostromin were estd. in the brain from subjects of different age. The difference in percentage of the neuroglobulin content in brains of 2-4 year old children and of grown-up subjects is only about 7%. The difference in neurostromin is about 26%. The conclusion is that the amt. of neurostromin increases with the development of the functional capacity of the brain. H. G.

Chemical composition of the grey matter of the human brain. A. K. LENZ. *Russ. Physiol. J.* 2, 145-69 (1919); *Physiol. Abstracts* 5, 458.—The grey matter of the cortex contains more water, N, and proteins (especially neuroglobulins), and less lipoids than

the grey matter of the basal ganglia. The most important chem. constituents of the central nervous system are the proteins; their amt. gradually diminishes from the higher centers to the lower, and to the peripheral nervous system. The neuroglobulin was extd. with 0.75% lactic acid.

H. G.

Digestion of vegetable and animal proteins by the gastric juice of the goose. L. V. KARPOV. *Russ. Physiol. J.* 2, 185-98(1919); *Physiol. Abstracts* 5, 469.—Two geese with esophagotomy and gastric fistulas were used. The juice was collected during sham feeding. The gastric juice was found to be 10-12 times weaker than in the dog (Mett's tubes and Landerer's method). Its acidity is also lower than in dogs (about 0.27%). The optimal acidity for the peptic digestion of different vegetable and animal proteins is the same for the juice of dog and goose. In both cases it is lower for vegetable proteins. It seems, therefore, that the acidity of the gastric juice is adapted in both animals to the food they generally use—in the dog with high acidity to the animal proteins, and in the goose with low acidity to the vegetable proteins.

H. G.

The salivary glands of the goose. S. K. NIKOVLINA. *Russ. Physiol. J.* 2, 198-215 (1919); *Physiol. Abstracts* 5, 469.—The saliva was collected through an esophageal fistula. Food and chem. stimuli cause a reflex salivary secretion. The saliva is very rich in mucin. The amt. of solids is slightly bigger in the saliva obtained by chem. stimulation than in that obtained with food. Its diastatic properties are high.

H. G.

Experiments on the relation of the hypophysis to the spasmogenic properties of some hormones. Y. PETRIVALSKY. *Sbornik Cekarsky* 25, 1-4(1920); *Physiol. Abstracts* 5, 426.—Subcutaneous injections of exts. of thymus and of exts. of the intestine cause in the wall of the intestine contractions which last 1-2 hrs. By extirpation of the hypophysis the excitability for both exts. (but especially intestinal ext.) is reduced. The spasmogenic power of spermin and pancreatin is smaller. By extirpation of the hypophysis the excitability for spermin diminishes, but it increases for pancreatin. The thyroid has the smallest spasmogenic effects.

H. G.

Discovery of the active principle of the thyroid gland. E. M. P. WIDMARK. *Svenska Läkartidn.* 17, 242-6(1920); *Physiol. Abstracts* 5, 365.—A description of the isolation of thyroxin in cryst. form by Kendall. Since this substance contains tryptophan, which cannot be synthesized in the body, the diet in cases of hyperthyroidism should contain as little tryptophan as possible in order to inhibit the production of thyroxin.

H. G.

Effect of temperature on the reaction of blood. JOSÉ MARIA DE CORRAL. *Anales soc. española fis. quim.* 18, 109-18(1920).—A discussion of the influence of temp. on the H- and OH-ion concns. of blood and serum. Attention is directed to the effect of equilibration with CO₂. The pH of blood is not affected by changes of temp. provided the blood is equilibrated with CO₂.

J. C. S.

Physiological significance of formic acid. A. SLOSSER. *Bull. soc. chim. biol.* 2, 150-6(1920).—Estns. of formic acid in urine and blood indicate that this substance represents a definite stage in the katabolism of many substances.

J. C. S.

Substances which form acetone in urine and the so-called physiological acetonuria. EMILIO PITTARELLI. *Rif. med.* 36, 303-6(1920).—A substance is present in urine which combines with acetone and thus masks the presence of the latter. The existence of this substance explains the negative result of the acetone test in a urine which yielded acetone when distd. Free acetone is never present in urine, which, however, contains a substance yielding acetone. A physiol. acetonuria, in the sense that every urine contains minimal amts. of acetone, is not existent.

J. C. S.

Determinations of the percentage of the organic content of compact bone. H. E. RADASCH. *Anat. Record* 21, 153-87(1921).—A study was made of the proportion

of org. constituents of bone to det. possible variations which might be associated with age. Every specimen was subjected to 4 detns.; when green, when oven-dried at 56° for 24-48 hrs., when extd. with 95% alc. and oven-dried, and when extd. with ether and oven-dried. The detns. showed that fetal bone is high in org. substance (83.99%), in full-term infants the content was 52.15%, at 20-60 years green bone showed 40.75%, and at 61-90 years in one instance a value as low as 39.13%. The percentages of moisture were: at 4½ mos. (fetal) 32.43%, at full-term 20.26%, at 20-60 years 8.44%, and at 61-90 years 8.89%. In one case a low value of 3.48% was secured among the last group. In oven-dried bone the org. substance, after removal of the water, was: 4½ mos. 46.63%, full-term 39.92%, 20-60 years 34.52%, 61-90 years 36.22%. The amt. of moisture and alc.-sol. material at birth was 24.24%, at 20-60 years 8.46%, at 61-90 years 9.01%. The amt. of moisture and ether-sol. substance for the same groups was 22.19%, 9.27%, and 10.87%. The real org. substance of compact bone at full-term was 29.55%, at 20-60 years 32.66%, and at 61-90 years 32.67%. The figures are averages of several detns. upon different specimens of human bone. Values for so-called "cleaned" bones were highly variable, owing to variation in the degreasing. Lower percentages were secured for green bone in the case of rabbits and cats than for human bone.

G. H. S.

The role of lactic acid in the occurrence and disappearance of muscular rigor. HANS H. WEBER. *Arch. ges. Physiol.* 187, 165-92(1921).—The author considers his expts. as offering strong confirmation of the theory of v. Fürth,—that rigor is associated with a swelling of the muscle due to lactic acid. The expts. upon vol. changes in the muscle were done in a specially devised "osmometer" by means of which slight changes in vol. could be read in a graduated capillary tube. When exposed to 0.02-0.05 *N* lactic acid in Ringer soln. considerable swelling occurred. Muscle coagulated by heat took up less water from a dil. HCl soln. than did fresh muscle. The observation of v. Fürth that protein swollen by acid undergoes a shrinkage when treated with 1% KCNS is interpreted to mean a removal of ions from the substance rather than a coagulation process. Heat coagulation is inhibited by acids. Acids inhibit the contraction due to KCNS. Muscle protein which coagulates in water fails to do so in weak lactic acid. These facts disprove the idea that resolution of rigor is due to lactic acid coagulation. During the resolution of rigor there is a loss in wt. and substance of the muscle. All of these facts suggest that the disappearance of rigor is connected with a liquefaction process, which in turn is associated with the process of excessive swelling.

G. H. S.

Organ substances with specific action. V. F. ABDERHALDEN AND E. GELHORN. *Arch. ges. Physiol.* 187, 243-68(1921).—Optones secured through fermentative decompn. of organ tissues show sp. action. Optones from corpus luteum, testis, and thymus retarded the spontaneous contraction of isolated heart muscle, although in weak concns. thymus optone apparently had a stimulating action. The same effects were observed upon atropinized strips. The reactions did not take place with the intact heart. Retardation of the pulsation disappeared with renewal of the bath soln. and upon the addition of BaCl₂. Prepn. rich in ganglion cells could not be differentiated from those poor in such cells by any of the reactions of optones. Surviving esophageal muscle reacted with an increase of tonus to corpus luteum, thymus, and testis optones; hypophysis and thyroid optones were less active. Optones from the anterior and posterior lobes of the hypophysis reacted differently upon the contraction of smooth muscle; the first stimulating, the second retarding it. Upon the surviving guinea-pig uterus both the anterior and posterior lobe optones were excitants, increasing the tonus. Thyroid, testicular, and ovarian optones increased the tonus; corpus luteum and thymus optones decreased the tonus of the uterine muscle.

G. H. S.

Reaction theory of respiratory regulation. HANS WINTERSTEIN. *Arch. ges.*

Physiol. 187, 293-8(1921).—Chem. regulation of pulmonary respiration is the result of the reaction obtaining in the respiratory center; increase in the p_H causes an increased respiration, decrease a diminished ventilation. The p_H of the respiratory center depends upon two factors, (1) the metabolic processes which occur within it, and (2) upon the reaction of the blood. The occurrence of an abnormal acid concn. of the blood causes a hematogenous hyperpnea; the accumulation of acid in the respiratory centers leads to a centrogenous hyperpnea. In both instances the CO_2 content, and the CO_2 tension, of the blood are reduced. Hematogenous hypocapnia is associated with an increase, centrogenous with a decrease, of the p_H of the blood. G. H. S.

G—PATHOLOGY

H. GIDEON WELLS

The serum treatment of scarlet fever and its relation to protein therapy. O. MOOG. Frankfurt. *Z. ges. expl. Med.* 14, 28-59(1921).—The serotherapy of scarlet fever has been attended by extraordinary success for the last 9 yrs. at the medical clinic in Frankfurt. Among the sera used have been convalescent serum, normal human serum and the antistreptococcus serum of Moser. The most marked results are obtained in the toxic cases when injected in the first 3-4 days. The therapeutic effect is not due to sp. immune bodies but is a non-sp. reaction. It is a remarkable fact, however, that normal horse serum and a series of immune horse sera possessed no therapeutic effect. This fact is a contradiction of the general conception of the influence of non-sp. proteins upon disease processes. In scarlet fever the action of serum therapy must be much more complex and the ordinary conceptions of non-sp. protein therapy are not applicable.

E. B. FINK

The mechanism of the gold-sol reaction in the cerebrospinal fluid. HEINRICH FISCHER. Halle. *Z. ges. expl. Med.* 14, 60-112(1921).—By the method of fractional salting out of proteins it was possible to isolate 4 globulin fractions from pathological spinal fluids: Fibrinogen fibrinoglobulin, euglobulin, pseudoglobulin I and pseudoglobulin II, all of which possessed a pptg. action upon colloidal gold. These results disprove the almost universal notion that globulins have a protecting action upon gold sols. The various fractions in the same globulin concn. have a different gold-pptg. activity. Pseudoglobulin I is more markedly pptg. than pseudoglobulin II; this is probably related to the fact that pseudoglobulin fraction II approaches fraction I in its physical properties (H_2O soly., salting out, etc.). The fibrinogen and fibrinoglobulin fractions were less pptg. than pseudoglobulin I in spite of the fact that their concn. was only a trifle less than the latter. This quant. difference in the behavior of the different globulin reactions is one factor in the explanation of the variation of the gold-sol. curve found in pathological conditions of the central nervous system. The alkali solns. of the globulin fractions in contrast with the aq. solns. show a shifting of the max. pptn. to the right; this is probably explained by the increased hydration of the alkali globulins with increasing concn. The first and second albumin fractions produce no pptn. of colloidal gold solns. They even prevent pptn. of gold by globulins and inorganic electrolytes such as NaCl. They function as protective colloids against these two classes of substances. The intensity and extent of max. pptn. are nearly proportional to the concn. of the globulin soln. There is an optimum pptn. point which is characteristic of the colloid and is dependent upon the behavior of the electrical charge of the globulin on the one hand and that of the colloidal gold particles on the other. E. B. FINK

The relation of typhus agglutination to the etiology of typhus fever. E. WEIL AND A. FELIX. Prague. *Z. Immunität.* 31, 457-512(1921).—Rabbits, injected intraperitoneally or subcutaneously with the brain of typhus-injected guinea pigs, constantly contain agglutinins for X 19. The brains of normal guinea pigs contain no such agglu-

tinins. The sera of typhus-injected rabbits are negative toward a series of microorganisms which are agglutinated by human typhus sera. These sera also fail to agglutinate *B. typhosus* and *X₁*. Agglutinins for *X* 19 do not appear in rabbits when the virus is heated to 58° for ¼ hr.

E. B. FINK

Experimental study of the influence of organs, organ extracts, exudates and secretions upon tubercle bacilli in vitro and therapeutic and immunizing experiments with tuberculosis of domestic animals. CL. GRESSE. *Z. Immunität.* 31, 533-8(1921).—The lymph glands of 2 tuberculous cattle and one cow and a pig served to reduce the virulence of tubercle bacilli. Kidney tissue of healthy and tuberculous guinea pigs also seemed slightly to reduce the virulence of tubercle bacilli. It remains to be tested whether such tubercle bacilli of diminished virulence can raise the resistance to tuberculous infection or can be used in the treatment of tuberculous animals. Expts. to test this point in guinea pigs have thus far been negative.

E. B. FINK

The use of the Sachs-Georgi fixation reaction for the detection of horse meat. W. GAERTGENS. Hamburg. *Z. Immunität.* 31, 512-32(1921).—The hemolysin-binding reaction of Sachs and Georgi gave a positive result in all cases where horse protein was shown to be present by pptn. methods or was more or less likely to be present. Partial reactions occur in material that does not contain horse meat, which is due partly to anticomplementary action and partly to non-sp. adsorption. Such non-sp. reactions are reduced to a minimum by previous heating of the material to 100° for 1-2 min. The property of binding heterogenetic sheep hemolysin seems to be widely distributed in the animal kingdom. In addition to the horse, dog and cat, the whale and camel are among the edible animals whose cells contain the hemolysin-binding receptors. Since the reaction is characteristic for no single species, its practical application is limited, but it may serve to confirm chem. and pptn. tests.

E. B. FINK

The creatinine coefficient in pulmonary tuberculosis. THEOPHILE RAPHAEL AND NINA ELDRIDGE. Seaview Hosp., New York. *Arch. Internal. Med.* 27, 604-7(1921).—The creatinine coeff. (Shaffer, *C. A.* 4, 2152) was below normal in all cases of tuberculosis studied. In the active stages of the disease, but before tissue waste had become excessive, the creatinine coeff. was slightly higher (6.80) than before (5.50) or later (5.84). There were 5 cases in each group.

I. GREENWALD

The blood urea nitrogen in acute intestinal obstruction. HENRY W. LOURIA. New York. *Arch. Internal. Med.* 27, 620-8(1921).—In 7 cases of acute intestinal obstruction, the urea N of the blood varied from 54 to 170 mg. per 100 cc. In one case, with blood urea N of 130 mg. the phenolsulfonephthalein excretion was 58% in 2 hrs. and 10 min.

I. GREENWALD

Liver regeneration following chloroform injury as influenced by the feeding of casein or gelatin. N. C. DAVIS AND G. H. WHIPPLE. *Arch. Internal. Med.* 27, 679-89 (1921); cf. *C. A.* 13, 2234; 14, 3712.—"After a 50-60% necrosis, a feeding period of 7 days with either substance (casein or gelatin) will restore the liver to within 10 or 15% of normal. This liver cell regeneration is comparable to that obtained with a meat diet, approaches that given by a high carbohydrate diet, is definitely less than with a full mixed diet but greater than with a fat diet or with fastings."

I. GREENWALD

The use of a high-fat diet in the treatment of diabetes mellitus. II. Blood sugar. L. H. NEWBURGH AND PHIL. H. MARSH. Univ. Mich. *Arch. Internal. Med.* 27, 699-705 (1921); cf. *C. A.* 15, 551.—The high-fat diet not only stopped the glucosuria but also reduced the level of blood sugar to normal.

I. GREENWALD

The total non-protein nitrogen constituents of the blood in arterial hypertension. J. LITTLE WILLIAMS. St. Luke's Hosp., Chicago. *Arch. Internal. Med.* 27, 748-54(1921).—Arterial hypertension may occur without evidence of N retention or other sign of diminished kidney function.

I. GREENWALD

Diet in relation to oral hygiene. WALLACE SECCOMBE. *J. Nat. Dental Assoc.* 8, 441-6 (1921).—The essential element in dental caries is the presence of carbohydrates. Salivary stasis is always present in caries, and is accompanied by fermentation. If the diet be rich in foods containing an excess of acid-forming elements, the susceptibility to caries is increased. Caries without salivary calculus is attributed to over-ingestion of sugar; caries with salivary calculus to over-ingestion of bread and flour products. Over-ingestion of any food may produce salivary calculus; indigestion, lack of mastication, or improper diet may give rise to a thickened saliva containing an excess of mucin. Over-ingestion, auto-intoxication, or trauma may be the cause of gingivitis.

JOSEPH S. HERBURN

Cephalorachidian fluid in encephalitis lethargica. ANON. *Bull. soc. chim. biol.* 2, 139-40 (1920); *Physiol. Abstracts* 5, 288.—A full analysis is given. H. G.

Experimental beriberi. Etiology of beriberi. F. CLAIR. *Bull. soc. pathol. exp.* 13, 191-6 (1920); *Physiol. Abstracts* 5, 473-4.—The conditions produced in pigeons by feeding with polished rice are said to have no connection with beriberi. In human beings the disease is due to toxic products of bacterial decompn. of rice. It is thus regarded as an infectious disease, though the agent has not yet been isolated. H. G.

Hypercholesterolemia in chronic nephritis with hypertension. COLRAT AND B. CORDIER. *J. urol.* 9, 81-7 (1920); *Physiol. Abstracts* 5, 477.—A description is given of a nephritic showing hypertension and abnormally high cholesterol content of the blood in the initial stages before urea retention was well marked. This suggests a correlation of the functions of the cortex and the medulla of the suprarenals. H. G.

Pathology of internal secretions. II. H. NAKAMURA. *Verhandl. d. jap. path. Ges.* 1919, 41-3; *Physiol. Abstracts* 6, 75.—Tying both spermatic cords in rabbits gives rise to an increase in body fat, a reduction in the amt. of the interstitial fatty tissue of the thymus and an increase of its lymphatic cortical substance, a colloid type of thyroid, a thickening of the adrenal cortex and an increase in the lipid content of its cells, an increase of the chromophil reaction of the medulla, and an increase in the chromophobe cells of the hypophysis. In human subjects from 50 to 90 years of age there is atrophy of the thymus and reduction in size of Hassal's corpuscles, as well as changes in the thyroid and reduction in the adrenal cortex. N. notes also the appearance of brown granular pigment in the posterior pituitary lobe and the disappearance of eosinophile cells from the anterior lobe. H. G.

Menstruation toxin. B. SCHICK. *Wiener klin. Wochschr.* 33, 395-7 (1920); *Physiol. Abstracts* 5, 319.—Certain flowers, particularly anemones when held in the hand of a menstruating woman, rapidly fade and die. Yeast is also damaged. The effect is due to a toxin present in the sweat, especially on the first day, and also in blood clot. H. G.

Lowering of freezing point of blood in diabetes. A. LIPPMANN. *Zent. inn. Med.* 41, 41 (1920); *Physiol. Abstracts* 5, 363.—The lowering of the f. p. is not parallel with the sugar content; substances other than sugar must also be increased. H. G.

The gastric contents during fasting in gastric ulcer. L. PRON. *Bull. acad. méd.* 85, 353-4 (1921).—Analyses of the gastric contents were made in 56 cases of proved gastric ulcer. In 45 cases there was free HCl, varying in amt. from mere traces to 2.92 g. (av. 0.75 g.). The total acidity in these cases varied from 0.53 to 3.65 (av. 1.81). Combined acid was not present in some cases, in others it reached a value of 2 g., with an av. for the series of 0.53. Acids due to fermentation were rarely absent; the av. was 0.48 g. Lactic acid was present in 26 cases. In 10 cases no free HCl was found, and in this group the highest total acidity was 1.46 (av. 0.71). Acids of fermentation were lacking in but 1 case; in 4 both lactic acid and volatile acids were present; in 5 only the volatile acids were found. In 1 case the contents of the stomach were of a catarrhal mucous character and were almost devoid of acidity (0.18 g.). G. H. S.

The question of resistance in premature infants. R. KYRKLUND. *Z. Kinderheilk.* 28, 168-82(1921).—The bactericidal action of the sera of infants weighing less than 2500 g. at birth was detd. in 60 cases. It was found that premature birth *per se* did not in any way affect the development of bactericidal antibodies. Infections, other than those associated with digestive disturbances, did not influence the bactericidal titer of the sera. In intestinal abnormalities the bactericidal potency of the serum is decreased. In premature infants the bactericidal activity of the serum is more readily disturbed than in full-term infants. G. H. S.

The Wassermann and Meinicke reactions in scarlet fever. E. THOMAS AND K. PASCHE. *Z. Kinderheilk.* 28, 208-15(1921).—Both reactions were performed on 150 sera derived from 50 cases of scarlet fever in children. Of the 150 tests 36 gave positive and 15 questionable fixation in the Wassermann reaction. All were negative with the Meinicke test. The positive reactions occurred particularly in the 1st week of the disease, tended to disappear in the 3rd week, reappeared in the 4th and 5th weeks, and finally disappeared in the 6th. The more severe cases, and those with complications, gave more positive fixations than did the mild cases. G. H. S.

Tetany in infants. ERICH NASSAU. *Z. Kinderheilk.* 28, 310-24(1921).—Aside from other contributory causes both the eclamptic and laryngospastic forms of tetany can be associated with disturbances in salt metabolism, such as excessive retention of Na and K as compared to the amt. of Ca present in active form. G. H. S.

H—PHARMACOLOGY

ALFRED N. RICHARDS

Anesthetic action of anesthesin (ethyl *p*-aminobenzoate and some of its derivatives). J. MORGENROTH. *Ber. pharm. Ges.* 31, 76(1921); *J. Chem. Soc.* 120, I, 384-5.—Comparative tests of the anesthetic action of anesthesin and certain of its derivs. were made on the cornea of the rabbit. Three minutes' treatment with anesthesin itself rapidly produced anesthesia lasting 32 min. Ethyl *p*-hydrazinobenzoate gave almost similar results, while ethyl *p*-allylthiocarbamidobenzoate had scarcely any anesthetic action. With respect to sol. compds., ethyl *p*-hydrazinobenzoate-HCl in 2% soln. after 3 minutes' action produced anesthesia lasting 9 min. The insol. substances act therefore more powerfully than their sol. salts. W. O. E.

War gas poisoning. X. Clinical picture of dichlorethylsulfide poisoning. REINHARD VON DEN VELDEN. *Z. ges. expl. Med.* 14, 1-27(1921). E. B. F.

Action of cocaine. A. GÖHARA. *Acta. Schol. Med.* (Kyoto) 3, 321-38(1920); *Physiol. Abstracts* 5, 487.—The action of cocaine was studied on various organs, and the results compared with those of other authors. The action of cocaine was contrasted with the action of adrenaline, and the conclusion is drawn that the action of cocaine has nothing to do with the sympathetic nerves. Small doses stimulate smooth muscle, and large doses inhibit. H. G.

Action of adrenaline on bacterial toxins. A. MARIE. *Ann. inst. Pasteur* 33, 645-56(1919); *Physiol. Abstracts* 5, 366; cf. *C. A.* 14, 3455.—Adrenaline renders innocuous the toxins of diphtheria and tetanus, abrin and crotoxin, probably by oxidation, which facilitates absorption by antibodies. It has no effect on poisons which are not antigens, such as strychnine, morphine, nicotine, cocaine, and tuberculin. H. G.

Synergism of drugs. IV. Scopolamine morphine. W. S. V. LEEUWEN AND M. V. D. MADE. *Arch. ges. Physiol. (Pflüger's)* 177, 276-93(1919); *Physiol. Abstracts* 5, 429; cf. *C. A.* 15, 1939.—The case for reinforcement of narcosis is doubtful, owing to the excitatory effects of scopolamine when this is given in any but relatively small doses. H. G.

Poisoning by phosgene. C. ACHARD, A. LEBLANC, AND L. BINET. *Arch. de*

méd. exp. 28, 623-43(1920); *Physiol. Abstracts* 5, 488.—Expts. with this poison gas on dogs and rabbits are given. In the first stage when the lungs are edematous, there is a transitory hyperglobia with increase of hemoglobin; this is followed by other toxic symptoms and anemia, then again by persistent hyperglobia (especially in the rabbit).

H. G.

Effect of adrenaline on blood of man and its relation to the splenic functions.

P. SCHENK. *Med. Klinik* 16, 279-82, 309-12(1920); *Physiol. Abstracts* 5, 367.—Doses of 1 to 1.5 mg. adrenaline were given to normal men and to various patients. In the normal men there was an increase of the white corpuscles, especially of lymphocytes, in about 30 min.; after 6 hrs. the blood-picture was normal again. In leucemias cells of the splenic tissue were recognizable. The results of the injection in other clinical conditions were variable.

H. G.

The effects of alcohol and some other drugs during normal and fatigued conditions.

W. M'DOUGALL and MAY SMITH. *Med. Res. Council* 1920, Special Report, Series 56; *Physiol. Abstracts* 5, 484.—Tests used are the windmill illusion, dotting machine, and related words. Alc. increases errors, diminishes accuracy, retention, control. Its effect varies with diln., time interval after food, and with the phase of the fatigue cycle; it is harmful during the initial excitant stage, and the first part of depressant stage; it differentiates the latter into 2 phases, being stimulant from about the 13th day. Opium improves memory and concn.; it facilitates and has a uniform stimulant action in fatigue; it diminishes power of distributing attention. From the windmill illusion, alc. and CHCl₃ appeared to raise synaptic resistance; strychnine, opium, tea to lower it; bromide had no effect. The suggestion is made that the nervous system, when strained, maintains its efficiency for a time by producing a stimulant substance, perhaps alkaloidal. Subjective sensations are not a safe guide, and are negated by objective results. H. G.

The action of vaso-constrictor substances on the blood vessels and pigment cells of the frog's web. II. G. T. STEPANOV. *Russ. Physiol. J.* 2, 103-15(1919); *Physiol. Abstracts* 5, 487.—Adrenaline constricts the blood vessels and evokes or increases their spontaneous periodic contractions. The action of adrenaline does not depend on the C.N.S. Digitalis, BaCl₂, and nicotine dilate the vessels, and do not give rise to periodic contractions if the C.N.S. is destroyed. The pigment cells contract when adrenaline or Ce salts are administered. Nicotine produces a short contraction, which soon passes off. Pituitrin does not contract the cells. Digitalis has no definite action. All these drugs were injected subcutaneously.

H. G.

Action of adrenaline and gland extracts on veins. S. H. TUGANE. *Seit. Kwai.*

M. J. (Tokyo) 38, 51(1919); *Physiol. Abstracts* 5, 479-80.—Ring preps. of veins of pig, dog, and cat contract when treated with adrenaline, just as arteries do. Dilatation is produced by saline exts. of lymph glands, kidney, liver, and muscle. No histological evidence is given of the existence of vasomotor nerves.

H. G.

Permeability of blood vessels. J. BAUER and B. ASCHNER. *Wiener klin. Wochschr.*

32, 1204(1919); *Physiol. Abstracts* 5, 366.—Injection of adrenaline increases the permeability of the blood vessels to water and chlorides. Pituitrin has no such effect.

H. G.

Protein therapy. G. HOLLER. *Z. f. Augenheilkunde* 44, 145-52(1920); *Physiol.*

Abstracts 5, 431.—H. gives a summary of the evolution of the method and the literature of protein therapy, and utters a warning on injudicious use of milk injections on account of the dangers of anaphylaxis.

H. G.

Influence of the acid radical on the anesthetic properties of amino alcohols. JOSÉ

MARIN CANO and JOSÉ RANEDO. *Anales soc. española fis. quim.* 18, 184-206(1920).—The anesthetic properties of hydrochlorides of various esters of dimethylaminodimethylcarbinol were studied. Measuring the times required for incipient and complete

anesthesia of the sciatic nerve of frogs, comparative estimates were obtained of the anesthetic powers of the compds. studied. The results lend support to the theory that within limits, anesthetic power increases with the mol. wt. of the acid radical of the ester. The esters of such dissimilar acids as benzoic, heptic and cyclohexanecarboxylic show almost equal anesthetic powers, presumably on account of their closely approximating mol. wts. In the esters of the fatty acid series, the theory only holds for intermediate numbers. Thus, while anesthetic power increases from the butyric ester to the undecolic ester, the palmitic ester is non-anesthetic. The hydrochlorides of the various esters used were prepd. for the first time and their identity was confirmed by analysis.

J. C. S.

Action of glycerol. II. Action of glycerol on the blood. ITALO SIMON. *Arch. farm. sper.* 30, 53-64, 77-80, 81-96, 102-12(1920); cf. *C. A.* 9, 3296; 15, 395.—Subcutaneous injection into rabbits of a single quantity of glycerol sufficient to produce hemoglobinuria causes modifications of the blood similar to those resulting from the withdrawal of a considerable amt. of blood. Repeated injections at short intervals of smaller quantities give rise to irritation of the lymphatic tissue, in addition to the effects of repeated small withdrawals of blood and to the entry into circulation of substances derived from the destruction of the red corpuscles and elements of the subcutaneous tissue. J. C. S.

Physiological action of β,β' -diiodoisopropyl alcohol and of β,γ -diiodopropyl alcohol. MARIO A. MANCINI. *Arch. farm. sper.* 30, 161-72(1920).—When introduced into the dorsal lymphatic gland of the frog, $(\text{CH}_2\text{I})_2\text{CHOH}$ causes torpor developing into complete muscular paralysis, while $\text{CH}_2\text{ICHICH}_2\text{OH}$ gives rise to tetanic convulsions, followed by muscular relaxation and death. The action of the latter isomeride appears to be due to the ease with which it decomposes into allyl alc. and I.

J. C. S.

A comparison of the action of benzene and cyclohexane on the formed elements of the blood. L. LAUNOY AND M. LÉVY-BRUHL. *Bull. soc. chim. biol.* 2, 145-9(1920).—Cyclohexane is some 3 times less toxic than benzene, and does not show the leucotoxic action so characteristic of the latter substance.

J. C. S.

Action of cyanogen derivatives on oxyhemoglobin. FRED VLVS. *Bull. soc. chim. biol.* 2, 223-38(1920).—The action of a large number of cyanogen derivs. on oxyhemoglobin was investigated, and the results are summarized in tabular form.

J. C. S.

The behavior in the animal organism of some pyrimidine derivatives containing sulfur. R. FREISE. *Z. physiol. Chem.* 112, 45-52(1920).—On feeding thiouramil and the NH_4 salt of thio- ψ -uric acid to dogs, a part of these compds. goes through the organism unchanged, while the other part is degraded, with the removal of the SH group. In the case of the thiouramil, about 49% of the substance undergoes cleavage during the passage, of which about a half is excreted as neutral S, while the remainder leaves the body as sulfates. About 86% of the thio- ψ -uric acid is degraded in the organism, of which 14% is excreted as neutral S and the remainder as sulfates.

J. C. S.

Investigations in scopolaminmorphine narcotics. W. STORM VAN LEEUWEN AND M. VAN DEN MADE. *Verslag. Akad. Wetenschappen Amsterdam* 23, 255-61(1920).—Morphine acts as a narcotic on rabbits, dogs, and man. The curve of dosage and narcotic effect takes the form of a parabola, i. e., in the beginning, the narcotic effect is greater when the dosage is increased, but later on an increase in dosage causes only a slight increase in narcotic effect. Scopolamine acts as a narcotic on rabbits; the curve illustrating the effects of concn. is identical with that of morphine. On dogs, the stimulating effect of morphine is more in evidence, while in man the narcotic effect is scarcely perceptible. The combination of scopolamine with morphine has a powerful effect on rabbits when the Haukold or reflex methods were employed. No such effect is noted in dogs. In man the effect is not constant.

N. KOPELOFF

Pharmacological study of heat narcosis in sea crabs (Palaemon). ALFRED

FRÖHLICH AND ALOIS KREIDL. *Arch. ges. Physiol.* **187**, 90-101(1921).—The critical temp. of heat narcosis in normal animals was between 36.5° and 37°; in animals which had become adapted to the lab. conditions the temp. was 1.5 to 2 degrees lower. The effect of environmental change upon the temp. of narcosis was detd. by altering the total concn. of the sea H₂O by diln. with distd. H₂O, or by varying the concn. of the individual components of the water. Reduction of the total concn. by one-half changed the temp. of narcosis to 34° after an exposure of 1 to 5 hrs. With one-fourth the normal concn. narcosis occurred at 34° to 34.5° in 30 min., and after exposure for 1 hr. at 33° to 33.5°. An exposure for 2 hrs. allowed a further reduction in temp. to 32°; and after 5 hrs. narcosis occurred at 31° to 32°. The sea water was deprived of individual chem. compds. Waters with Na, Ca, and Mg, but without K; with Na and K, but without Ca and Mg; with Na and 2 K (or 3 K) but without Ca or Mg modified the temp. of narcosis but little. NaCl solns. alone (1 or 2%) reduced the temp. to 32°. More pronounced effects were secured by increasing the various compds. HCl added to 1:10,000 concn. changed the temp. of narcosis to 36° with an exposure of 30 min. In camphor, 1:20,000, 36° was effective after 2 hrs. Ephedrine 1:1,000 acted at 36° in 30 min. Caffeine could not be used since it killed the animals quickly in dilns. as high as 1:5,000. With nicotine, 1:100,000, the critical temp. was 36.5° in 1 hr. Strychnine gave complicated reactions, as did cocaine, although the latter in 1:1,000 concn. was effective at 32° after 30 min. Physostigmine, 1:100,000, induced narcosis at 35.5° in 3 hrs.; and atropine, 1:10,000, was active at the same temp. in 2 hrs. A series of tests with chloral hydrate and with alcohol gave the following results; chloral hydrate 1:5,000 in 1 hr. at 37°, 1:500 in 1 hr. at 35°, and 1:100 in 17 min. at 32.5°; alcohol 1:1,000 in 30 min at 37°, 1:500 in 30 min. at 37°, 1:100 in 15 min. at 30° to 31°, and 1:50 in 15 min. at 29°. G. H. S.

Light reactions in crabs (*Palaemon*). A. FRÖHLICH AND A. KREIDL. *Arch. ges. Physiol.* **187**, 102-4(1921).—Camphor and phenol increased the sensitivity of crabs to light. Strychnine and ammonia did not affect the reactions. G. H. S.

Physiology of hemostatic agents. P. EMILE-WEIL. *Bull. acad. méd.* **85**, 265-6(1921).—All hemostatic agents are either (1) substances which affect the vasomotor app., as constrictors or as dilators, or (2) coagulants. Ergotine, adrenaline, pituitrin, amyl nitrite, etc., belong to the first group; gelatin, blood serum, and peptone represent the second. Many of these agents—blood serum, pituitrin—modify both the blood and the circulation. There are other compds., as emetine, that act as hemostatics which seem to act neither as coagulants nor as vasomotor excitants, and for these a physiol. explanation of their mechanism is lacking. G. H. S.

Relation of alkali phosphates to spasmophilia. KARL JEFFSSON. *Z. Kinderheilk.* **28**, 71-167(1921).—The effect of various phosphates, chiefly K and Na diorthophosphate, was detd. in normal children and infants with spasmophilia, as well as upon dogs and rabbits. The usual dosage was 0.2 g. P₂O₅ per kg. of body wt.; this amt. was rarely exceeded and frequently 0.1 g. was sufficient to cause the effect desired. Accepting as the most constant symptom of spasmophilia an increased irritability to electrical stimuli, detns. of reactivity were made both before and after the administration of K₂HPO₄ and Na₂HPO₄. The alkali administration caused an increased irritability which appeared within ¼-2 hrs. and which attained its max. intensity in 2-4 hrs. If but one dose of phosphate was given the reactions had returned to normal by the following day. The reactions thus induced presented all the characteristics of typical spasmophilia. The alkali phosphates also caused, within 1-2 hrs., an increase in susceptibility to mechanical stimuli. Tetany and laryngeal spasm occurred. Symptoms of the same nature followed the administration of the phosphates to dogs and rabbits. The expts. showed that the original assumption that the K and Na salts acted alike was

incorrect, for while the effects were in general very similar, the K salt was the more potent in its action and more constant in its effects. These variations may be ascribed to the greater soly. of the K phosphate, a condition which would favor absorption. The Na salt at times appeared to have a cumulative action. In order to det. which ions of the salts were responsible for their action a series of salts were tested, including K_2HPO_4 , KCl, KBr, KI, KNO_3 , K_2SO_4 , $KHCO_3$, K acetate, K oxalate, and K citrate. A similar series of Na salts were used. Some of these were active, others were not, and it appeared that the activity of the K_2HPO_4 could not be ascribed exclusively to either the one or the other ion. All alkali salts do not effect this action on the motor system, nor does the phosphoric acid factor alone possess the activity. Of the Na salts, only the phosphate was active. The effect of the HPO_4 ions cannot be explained absolutely upon their ability to diminish the Ca content of the organism; other factors may contribute. In spontaneous spasmophilia in children it could usually be shown that there had been an excessive ingestion of alkali phosphates. Analysis of the organs—brain, muscles, bones—of cases of rachitis and spasmophilia demonstrated an abnormally high deposition of P in these tissues. A possible relationship between tetania parathyreopriva, alkali phosphates, and guanidine is suggested. A direct relationship between alkali phosphates and the "spasmogenic" property of cow milk is shown, since feeding with milk rich in alkali phosphates increased the electrical and mechanical irritability. This increased reactivity did not follow when the milk used had been deprived of its phosphates.

G. H. S.

The active principles of grape wine (KOOTATLADSE) 16.

I—ZOOLOGY

R. A. GORTNER

The distribution of nitrogen between the developing chicken and egg yolk. N. V. ROMENSKII. *Russ. Physiol. J.* 2, 268-84(1919); *Physiol. Abstracts* 5, 482.—The body of the newborn chicken has 57.1 to 65.8%, and the residual egg yolk 27.6 to 37% of the total N. After 36 hrs. starvation the body contained the same amt. of N as before: the N of the egg yolk was diminished 2 or 3 times. The conclusion is that the egg yolk is a store of food supply, the N of which is used during starvation.

H. G.

Osmotic pressure necessary to arrest cellular division. F. VLÉS AND J. DRAGOIU. *Compt. rend.* 172, 1127-30(1921).—Sea urchin eggs at the moment of diaster of the first division were plunged into solns. practically isoelectrolytic but made of regularly increasing osmotic pressure by the addition of sucrose to the sea water. The osmotic pressure of sea water was taken as 25 atm. Pressures between 27 and 30 atm. exerted a slight retardation upon the division. From 30 to 50 atm. the percentage of eggs which completed the first division dropped rapidly as the osmotic pressure increased, reaching zero at about 42 atm. The mean pressure to prevent the division was 36 atm., an excess of 11 atm. over that of the normal medium for the eggs. Accordingly this 11 atm. represents the internal osmotic pressure of the cell during division. At pressures between 50 and 100 atm. the eggs assumed capsular or tetrahedral forms. L. W. RIGGS

Parthogenetic activation of eggs of *Rana temporaria* L. in hypotonic and hypertonic media. R. HOVASSE. *Compt. rend.* 172, 1137-9(1921).—Segmentation of the eggs occurred in ordinary water, distd. water, and hypertonic solns. of various salts, sugar and urea. It was slower in distd. than in ordinary water. No relation appeared between the percentage of segmentations and the concns. of the salt solns. An attempt is made to account for the phenomena on the basis of the imbibitional or synergetical action of the colloids of the egg.

L. W. RIGGS

Occurrence of *Gammarus limnaeus* in a saline habitat. R. A. GORTNER AND J. ARTHUR HARRIS. *Science* 53, 460-2(1921).—*G. limnaeus* Smith a typically fresh

water species was found in a pool in the old lava vent of the Terrace crater of the Ice Springs lava field of the Sevier Desert, Utah. The water of the pool contained 7.92 g. of solids per liter of which 4.83 were NaCl, 0.59 KCl, 0.88 CaSO₄, 0.80 MgSO₄, 0.30 MgCl₂, 0.29 Ca(HCO₃)₂, and 0.15 Na₂SiO₃. L. W. RIGGS

12—FOODS

W. D. BIGELOW AND A. E. STEVENSON

Nutrition during the blockade. M. RUBNER. *Arch. [f. Anat.] Phys.* 1919, 1-23; *Physiol. Abstracts* 5, 359.—Tables give the compn. of various additions to the bread which was eaten during the war in Germany. Expts. on the digestibility of this bread and of other surrogates are described. H. G.

Aroma-producing substances formed during the souring of cream. F. W. J. BOEKHOUT AND J. J. OTT DE VRIES. *Verslag. Land. Onderzoek. Rijkslandbouwproefsta.* No. 24, 1-11(1920).—B. and de V. briefly discuss the investigations that have been made on the above subject. They were able to isolate a species of microorganism which was shown to possess the property of imparting to butter a peculiarly agreeable aroma. The authors discuss at length this class of organism, giving cultural characteristics, methods of isolation and proper conditions under which the organisms can be used profitably. Two photomicrographs are given. P. J. DONK

The moisture content of milk powder. N. SCHOORL AND S. C. I. GERRITZEN. *Univ. Utrecht. Pharm. Weekblad* 58, 370-8(1921).—In a study of the detn. of moisture in milk powder it was observed that drying at 103° gives nearly the same result as at 95°, but at 110° there is a great difference. Above 103° some caramel formation occurs, with loss of H₂O, and const. wt. is not easily reached. The const. wt. attained at 95° requires a very long time and represents an equil. with the atm., not complete drying. It generally gives the moisture content about 2% too low. At 103° the result is about 1.5% too low. Drying at 100° in a current of dry air gives a result within about 0.5% in 2 hrs.; with very long drying the result is accurate. Drying at 110° in ordinary air gives a result within a few tenths of 1% if the weighing bottle rests on a pad of asbestos. Addition of sand to the powder is unnecessary. JULIAN F. SMITH

New dye for the recognition of abnormal milk. J. J. O. DE VRIES. *Nederl. Tijdschr. voor Melk-hygiene*. 1920, 83; *Analyst* 45, 450.—Van Slyke and Baker (cf. C. A. 14, 301) suggest the use of bromocresol purple (dibromo-*o*-cresolsulfonephthalein) for the rapid detection of abnormal milk. V. has investigated their statements. On the addition of 1 drop (1/20 cc.) of the satd. aq. soln. of the dye to 3 cc. of the milk, a coloration is developed: greyish blue with normal milk, dark blue with a lower content of acid, and light green to light yellow with a higher content. The higher content of acid may be due to formation or addition of acids, acid salts, or CH₃CO, or too great a degree of pasteurization. If the color is bluish, the milk is from an inflamed udder, or is watered or deprived of cream, or alkali has been added. H. G.

Bleached flour in United States of America. ANON. *U. S. Dept. Agr., Bur. of Chemistry, Service and Regulatory Announcements*, No. 26, 21; *Analyst* 46, 139(1921).—The Bureau regards as adulterated flour bleached by any process, if the bleaching has reduced the quality or strength or has concealed damage or inferiority. Bleached flour may, however, be shipped within the jurisdiction of the U. S. A. Food and Drugs Act if it satisfies the above requirements, provided that it is branded to indicate that it has been bleached. No action will be taken at the present time on the ground that bleaching introduces into the flour a substance which may be injurious to health, provided, as a result of bleaching, there is not introduced such a quantity of the bleaching

agent as may render the flour injurious as indicated in a decision of the Supreme Court.

H. G.

Relation between the mechanical properties of dough; and bread-making. M. CHOPIN. *Bull. soc. encour. ind. nat.* 133, 261-73(1921).—An app. is described and figured by means of which it is possible to measure the tenacity of a dough in terms of the effort necessary to cause a sample to assume a given shape in a const. time, and to measure the capacity of the dough to stretch into a thin membrane. It is shown that temp., compn. of the dough, method of working the dough, age of the flour, and length of time the dough is allowed to stand, all have an influence on the results. Measurements with numerous samples of flour show that the difference between the sp. vol. of bread which can be obtained with a flour and the initial sp. vol. of the dough from this flour is proportional to the square root of the coeff. of extension of this dough developed in a thin membrane. Thus it is possible to det. the index of swelling during bread-making and the yield of bread from a given flour.

J. S. C. I.

Analytical investigations on a bread prepared with wheat dough. O. MATTIOLO AND G. ISSOGLIO. *Ann. r. accad. agr. Torino* 61, 32-51(1918).—The wheat was soaked approx. 3 days with 4 changes of H₂O till it showed signs of sprouting, then drained and ground for 10 hrs. to a dough from which the bread was baked with the addition of salt and yeast. Analyses are given of the wheat, the waters in which it was soaked, the dough and the bread.

ALBERT R. MERZ

Changes taking place in the tempering of wheat. E. L. TAGUR. *J. Agr. Res.* 20, 271-5(1920).—Before grinding wheat, it is the practice to add water to bring the total moisture present up to 15.5% and to allow to stand for 12-48 hrs., with the result that the bran is toughened and more readily sepd. and the flour obtained in higher yield and of better color. The principal factors involved are amt. of water added, time, and temp. Three varieties of wheat were tempered with water in a closed bottle in a thermostat for a definite time, and were then ground to flour. Water exts. of the flours were prepd., and detns. were made of the p_H concn., the total acidity, the sol. P, and the N titratable by the Sørensen formaldehyde method. Tempering at 5° caused little change in the flour compared with an untempered flour. At 20° chem. changes took place, each of the above detns. giving higher results than with the untempered flour; time also appeared to increase the action and the yield of flour was larger. At 40° the changes were more pronounced, but the milling properties of the wheat had deteriorated, especially after lengthening the time. Increasing the water to 18% produced a sticky flour. The general conclusion is drawn that the improved milling quality of tempered wheat is due chiefly to physical changes.

J. S. C. I.

The composition of cereal grains; mistakes made in locating the chemical constituents of wheat and rice grains; aleurone. G. VARESCHI. *Ann. accad. agr. Torino* 61, 3-31(1918); *Bull. Agr. Intelligence* 11, 176.—The distinction between aleurone and the proteins in the starchy portions of the grain is pointed out. Rice contains glutenin, gluten-casein, gluten-fibrin and edestin, but not gliadin which is typical of true gluten. Wheat and rye contain conglutin, glutenin and gliadin. To avoid confusion the term aleurone should be abolished.

T. G. PHILLIPS

Rice growing in Greece. P. PAPAGEORGIOU. *Ann. Gembloux* 25, 93-7(1919); *Bull. Agr. Intell.* 11, 188-90.—A summary of the industry. An analysis of Grecian rice is compared with that of imported varieties.

T. G. PHILLIPS

A study on rice from the Cameroons. HRIM AND HUSSON. *Ministère des Colonies, Bull. Agence Generale des Colonies* 12, 569-74(1919); *Bull. Agr. Intelligence* 11, 190.—Three varieties of rice, two from Yoko and one from Duala, had an exceptionally high protein content, averaging about 8.5% for the dehusked rice. These varieties are suitable for distg. and brewing.

T. G. PHILLIPS

Bombay mace. ANON. *U. S. Dept. Agr., Bureau of Chemistry, Service and Regulatory Announcements* No. 26, 21-2; *Analyst* 46, 139(1921).—Although "Bombay mace" closely resembles true mace in appearance, and is botanically a mace, it is practically devoid of flavor, and is useless as a spice. Its use in spices is merely as a filler and adulterant, and the Bureau of Chemistry is of the opinion that it should not be used as an ingredient of spices, even when these are labelled to show its presence. H. G.

I. Nutritive value of pine tree bark for man. II. Nutritive value of hay meal for man. C. TIGERSTEDT. *Öfversigt af Finska Vetenskaps Soc. Forhandl. A. Math. og. Naturv.* 1918-19, Helsingfors, 1920, 61, No. 16, 1-16; *Ibid* No. 17, 1-13; *Physiol. Abstracts* 5, 308.—The nutritive value in both cases is low. H. G.

Coconut press cake as protein food for man. B. C. P. JANSEN. *Med. geneesk. lab. Weltevreden (Java)* 1920, 3e Ser. A, Nos. 1, 2, 3, 1-21; *Physiol. Abstracts* 5, 360; cf. *C. A.* 14, 2811.—The residue obtained from coconuts after pressing out the oil was given to rats. If fat-sol. vitamine is added to a diet in which the only source of protein is coconut residue, growth occurred; this shows that the proteins are not deficient in any essential amino acid. Three expts. on man showed that about 75 to 80% of the coconut protein was absorbed, this being about the amt. absorbed of other vegetable proteins. The coconut cake may be used in an emergency as a source of human food in the Indies. H. G.

Contributions to the practical application of the precipitin reaction with special consideration to investigations of honey. K. LASKER. *Doctorate dissertation, Schlesische Friedrich-Wilhelms-Universität, Breslau* 1915, 83 pp.—The quant. precipitin reaction is a valuable aid for the identification of honey and its products. Those honeys giving no ppt. with honey albumin antiserum cannot be considered genuine. Chem. analysis must here decide whether the honey is artificial and contains no bee honey or has been too strongly heated. Where a ppt. is obtained its quantity may (1) equal that of the control honey or (2) be less. (1) identifies a genuine bee honey; (2) indicates that the honey is not genuine and chem. examn. must det. whether heating has caused its deterioration or whether it is a mixt. ALBERT R. MERZ

The evaluation of artificial honey. VL. STANEK AND J. VONDRÁK. *Listy Cukrovní* 39, 9-11(1920); *Z. Zuckerind. Tschoslov. Rep.* 45, 203-5(1921).—In order to obtain a finished product indicating 80° Balling the ratio of sugar to water, before inversion, should be 78.1 to 21.9. An analytical method for controlling the process was sought for. The saccharification values detd. by König's din. method (*Z. Nahr. Genuss.* 3, 760) were too high. Best results were obtained by using Schönrock's refractometer, which gave results nearly identical with those obtained with a Kovač pycnometer. JOHN M. KRNO

Detection of incipient putrefaction in meat. R. STROHECKER. *Chem. Ztg.* 44, 744(1920); *Analyst* 45, 449-50.—Six 300 cc. Winkler O flasks are charged each with 5 g. of sample and filled up with water at 40°. They are incubated resp. for 0, 2, 4, 6, 8 and 10 hrs. at 23°. Absence of O after 4 to 6 hrs. as shown by the Winkler method indicates incipient putrefaction. Meat beginning to decompose (5 g. in a 60 cc. O flask filled up with a nitrate soln. contg. 3 mg. N_2O_5 per l) completely destroys the nitrate in 2 to 4 hrs. of incubation. Fresh meat requires much longer. Nitrite soln. gives similar results. A method depending on the detection of amino acids by the "ninhydrin" reaction gave less satisfactory results; methods based on the presence of other decomposition products, as also on the concn. of H ions in fresh and decomposed meat, were unsuccessful. For the detection of advanced putrefaction 10 g. of the sample, with 1 cc. of Schardner's methylene-blue soln., are incubated at 45° in a 60 cc. O flask, completely filled with water and sealed. Distinct decolorization in 45 min. indicates putrefaction. H. G.

Method of identifying dried sugar beet and mangels. V. STANEK. *Z. Zuckerind.*

Böhmen 42, 291-293(1919); *Bull. Agr. Intelligence* 10, 994-5.—It is known that the dry matter of sugar beet contains less ash and much less alkali and N than the dry matter of fodder beet. S. has sought to establish, by detg. the ash content, a means of distinguishing dried sugar beet and mangels. The material is dried and pounded in a porcelain mortar; 7 to 10 g. of the powder thus obtained are weighed out, desiccated and burned; the ash is weighed, dil. cold HCl added, filtered, and then the insol. residue is dried and calcined. In this way the wt. of total ash is detd., and that of ash insol. in HCl and also that of ash sol. in the acid. On analyzing some samples of known origin, S. obtained the following data for the above 3 quantities (as percentages): sugar beet: 3.59-1.24-2.35; yellow mangel: 5.94-0.84-5.10; *idem*: 6.50-0.28-6.22; white half-sugar beet: 4.67-1.34-3.33; red mangel: 7.69-0.87-6.82; white half-sugar beet: 5.50-0.19-5.31; sugar beet: 2.40-0.12-2.28. It will be seen that the dry matter of sugar beet contains from 2.28 to 2.35% of ash sol. in dil. HCl; that of half-sugar beet from 3.33 to 5.31%, and that of mangel from 5.10 to 6.82%. Hence, it is possible, on the basis of these data, to distinguish mangel beet from sugar beet when homogeneous material is being dealt with. A content of sol. ash varying around 3% would indicate a mixt. of mangel and sugar beets.

H. G.

Composition and food value of certain shells, husks, and other waste vegetable materials. F. HONCAMP AND E. BLANCK. *Kunstdünger u. Leim. Z.* 17, 54(1920); *Chimie & industrie* 5, 707(1921); cf. *C. A.* 14, 423.—Expts. by H. and B. have given the following results. The figures are calcd. to the dry basis, except the starch value.

	Buckwheat tegument	Rapeseed tegument	Tegument of corn	Yellow clover pericarp	Northern oat flour
Crude protein.....	3.56	11.03	15.43	16.74	3.98
Digestible protein.....	0.23	5.75	11.55	8.34	1.64
Pure protein.....	...	...	14.25	16.06	3.78
Pure albumin.....	3.41	10.19	...	...	...
N-free extract.....	46.67	38.96	67.94	46.90	58.10
Digestible extract.....	11.53	20.80	61.01	22.08	19.07
Crude fat.....	0.53	8.49	0.45	2.25	2.04
Digestible fat.....	0.53	7.31	0.23	1.14	1.41
Crude fiber.....	48.93	25.76	11.45	26.28	30.60
Digestible fiber.....	4.06	14.11	11.45	18.00	13.31
Ash.....	1.31	15.70	4.73	7.85	5.22
Starch value.....	...	31.9	71.8	36.2	25.2

A. P. C.

The salt or sodium chloride content of feeds. G. S. FRAPS AND S. LOMANITZ. *Texas Agr. Expt. Sta., Bull. No. 271*, 14 pp.(1920).—To det. the quantity of added salt in fodders, 5.85 g. of the sample are treated with sufficient water to make up 200 cc. and the mixt. is shaken for 1 hr.; 80 cc. of the soln. are treated with 1 g. of carbon black or 1 g. of Pb acetate, filtered, and 50 cc. of the filtrate are acidified with HNO₃, an excess of 0.1 N AgNO₃ soln. is added, and the excess then titrated with 0.1 N thiocyanate soln., using ferric alum as indicator. All unmixed fodders contain but small quantities of NaCl, with the exception of alfalfa (lucerne) (1.0%), molasses (1.12%), and some meat products (1.3-2.8%).

J. S. C. I.

Studies on digestibility of sunflower silage fed to sheep. J. SOTOLA. *Washington Agr. Expt. Sta., Bull. 161*, 1-11(1921).—Sunflower silage made by ensiling fairly mature sunflowers was found to have a nutritive ratio of 1 to 11.5 when fed to 2 lambs as compared to an av. for all classes of live stock of 1 to 17.9 for corn silage. It contained 12.55% of digestible nutrients as compared to 19.04% for corn silage but the value of the former was only 66% that of the latter. The crude protein of sunflower silage was

12.4% more digestible than that of corn silage but the crude fiber and N-free extract were, resp., 40 and 18% less digestible.

W. H. ROSS

Results of investigation into the self-heating of hay. G. LAUPFER. *Landw. Jahrb. Schweiz* 34, 1-64(1920); cf. C. A. 14, 632.—The view put forward is that the moisture from withered hay in a stack is able to activate the oxidases present in dried green hay with consequent chem. action and heat evolution. Microorganisms play no part in the process. The following sequence of events was ascertained: At 20-35°, activation of the oxidases, commencement of heating; at 35-45°, caramelization of sugar; at 45-70°, evolution of NH_3 and formic acid; at 60-70°, acceleration of the exothermic reaction; at 70-90°, decompn. of pectins, pungent odor; at 90-100°, first decompn. of protein, formation of H_2S and furfural; at 110-70°, formation of HNO_3 by oxidation of NH_3 , explosive union between NH_3NO_3 and caramel C; at 170-250°, rapid progress of the exothermic reaction; at 250-80°, decompn. of cellulose and protein, formation of H_2S and furfural, ignition of pyrophoric Fe; at 300°, region of inflammability through access of O; at 320-40°, final decompn. of carbohydrates, formation of furfural and pyrophoric manganese. The injection of CO_2 into the stack does not remove the danger of fire.

J. S. C. I

Some aspects of pollution as affecting oyster propagation (NIELSON) 14. Coffee bean as a poisonous plant (MARSH, CLAWSON) 11D. Classification and identification of coal-tar dyes (ANON.)25.

Dehydrated milk powder. S. M. DICK. U. S. 1,374,555, Apr. 12. A dry powder is formed from whole milk by atomizing the milk without pressure into a drying chamber where it is subjected to currents of heated air. The butter fat particles are maintained in their normal condition and are coated with a film of casein, albumin and other colloidal constituents of the milk. On the addition of H_2O , a liquid substantially similar to normal milk is obtained, on which the cream will rise.

Butter-fat gage. J. A. MEKKER. U. S. 1,375,057, Apr. 19. The gage comprizes adjustable pointers adapted for facilitating reading of graduations on a test bottle neck.

Apparatus for aerating and maturing flour. W. G. MILLER. U. S. 1,376,110, Apr. 26.

13—GENERAL INDUSTRIAL CHEMISTRY

HARLAN S. MINER

The principal industrial applications of catalysis. PAUL RAZOUS. *Industrie chimique* 8, 135-8, 213-6(1921).—Brief outline of various catalytic processes: prepn. of anhydrous H_2SO_4 from SO_2 , synthesis of NH_3 and its oxidation to HNO_3 , oxidation of MeOH to formaldehyde, hydrogenation of AcOH to EtOH , prepn. of acetaldehyde, AcOH and acetone, prepn. of artificial geranium ext. by dehydration of phenols, hydrogenation of oils, and others.

A. P.-C.

Physical principles of the liquefaction of air. R. PLANCK. *Z. ges. Kälte Ind.* 27, 1-8(1920); cf. C. A. 14, 1915.—In the liquefaction of air the cooling due to the Joule-Thomson effect for small differences of pressure has been found to be above $\frac{1}{2}$ at 200° abs., over $\frac{1}{2}$ at 175° abs., and about 87% at 150° abs. of that produced by adiabatic expansion. Adiabatic expansion is never fully attained in practice. J. S. C. I.

Exact data on the performance of steam boiler plants; average figures for the performance of some different types of steam boilers. D. BROWNLEE. *Engineering* 110, 769-61, 797-9(1920).—The figures given are averaged from the results of the investigation of nearly 500 steam boiler plants in many different industries. J. S. C. I.

Alternatives to coal for power production. PERCY E. RYCKOFF. *Electrician* 86, 783-5(1921).—A detailed review. No well defined cost comparisons are included.

C. G. F.

Hydroaromatic compounds: their uses in industry and in the laboratory. J. H. FRYDLENDER. *Rev. prod. chim.* 24, 365-8(1921).—See Schrauth, C. A. 15, 1824.

Acid cleaning of condensers. N. G. HARDY. *Elec. World* 78, 64(1921).—The cost is about 20% that of mechanical cleaning old water tube condensers because loss of tubes is negligible. 24% HCl was used. Full details of procedure are given.

C. G. F.

Temperature variation of viscosity of lubricants. L. GÜMBEL. *Z. tech. Physik* 1, 47-51(1920); *Science Abstracts* 24B, 112.—A description of the various formulas hitherto proposed as representing empirically the relation between viscosity and temp. for various kinds of lubricating oils. G. proposes a modification of the formula of Poiseuille in the form $(1/\eta) = (1/\eta)_{\min.} + c(\theta - \theta_{\min.})^2$ for this relationship, $(1/\eta)$ being the fluidity at temp. θ , and c being a const. of the oil. The term $(1/\eta)_{\min.}$ becomes relatively unimportant as θ increases and c becomes a very useful criterion of the quality of the lubricant as it shows the extent to which the viscosity changes with rise of temp. A table is given showing the values of $(1/\eta)_{\min.}$, $\theta_{\min.}$ and c for various known lubricants and from this it appears that the viscosity of olive oil is the most const. with change of temp., c being smallest for this substance. The formula proposed is shown to represent the observed values of viscosity more closely than either of the formulas hitherto employed.

H. G.

A new anemometer [measurement of the velocity of gases in pipes] (GERDIEN, HOLM) 1.

Jahresbericht über die Leistung der chemischen Technologie für das Jahr 1918. Leipzig: Verlag von Johann Ambrosius Barth. For review see *Z. Ver. Gas Wasserfach.* 60, 70(1921).

JUDGE, ARTHUR W.: **Aircraft and Automobile Materials of Construction.** Part II, "Non-Ferrous and Organic Materials." London: Sir Isaac Pitman & Sons Ltd. 594 pp. 25s. For review see *J. Inst. Metals* 25, 482(1921).

SAUFERT, FRANZ: **Technische Wärmelehre der Gase und Dämpfe.** Berlin: J. Springer. 11 M.+Teuerungszuschlag. For review see *Papier-Ztg.* 46, 2323.

Conditioning air for drying, sterilizing or similar purposes. A. P. TORREY. U. S. 1,374,689, Apr. 12. Air is prep'd. for use in driers, sterilizers or the like by passing it through filters and H₂O and then compressing and heating it.

Dehydrating compressed gases. W. WILKINSON. U. S. 1,376,985, May 3. Gases such as O or N are dehydrated by cooling in successive stages and sepg. condensed moisture. In one stage of the cooling, heat interchange is effected between two successive portions of the gas under treatment.

Evaporating water, etc. GRISCOM-RUSSELL Co. Brit. 158,221, Aug. 20, 1920. In evapg. systems, particularly those for distg. make-up feed-water for steam-engine plants, a portion of the residue is evapd. by its own heat and the vapor used for pre-heating the feed-water. A suitable app. is specified.

Recovering alcohol and ether vapors from air. E. BINDSCHEDLER. U. S. 1,376,069, Apr. 25. Air containing alc. and ether vapors is first brought into contact with H₂O to absorb alc. and the air and ether vapor mixt. freed from alc. is brought into intimate contact with concd. H₂SO₄ to absorb the ether.

Filtering material. E. MÜLLER. U. S. 1,375,532, Apr. 19. A filtering material

adapted for purifying various liquids is formed by treating ashes of vegetable material with Na silicate, washing, drying and comminuting the material, forming it into a plastic mass by mixing it with H₂O and pulverized clay, molding, drying and baking at a glowing temp.

Lubricating oil. R. H. BROWNLEE. U. S. 1,374,277, Apr. 12. See Brit. 141,753 (C. A. 14, 2549).

Impregnating fibrous material with insulating substances. W. WEIMAR. U. S. 1,375,125, Apr. 19. Wood pulp or fiber or similar fibrous material is rendered non-absorbent and its insulating properties are improved by treating it with a hot Na₂CO₃ soln., drying it, immersing it in hot hydrocarbon liquid to neutralize the odor of the S subsequently used and to expand the pores, drying it, placing it in a soln. of resin and S heated sufficiently to keep the S molten until it has impregnated the material and then removing and suddenly cooling it.

14—WATER, SEWAGE AND SANITATION

EDWARD BARTOW

Significance of hydrogen-ion concentration in drinking water and particularly for the business of water supply. A. MASSINK AND J. A. HEYMANN. *J. Am. Water Works Assoc.* 8, 239-69(1921).—The corrosive action of a water supply depends not only upon H-ion concn. but also upon O present. Too high *p_H* indicates possible corrosion of water mains and other metal objects, greater difficulty in iron removal, decolorizing, etc. "Aggressive" CO₂ and "appropriate" CO₂ are described. Tillman's formula, which is the basis of the article involved H-ion concn., free CO₂ and bicarbonate CO₃—given two of the above, the third can be calcd. and "aggressive" CO₂ detd. These detns. all bear on drinking-water problems. The article goes into great detail.

D. K. FRENCH

Method of examination of mineral water and spring water. Report of Committee on Hygiene and Public Health, Pharm. Soc., Japan. *J. Pharm. Soc. Japan* No. 469, Supplement 1-81(1921).—Official methods of physical and chem. analysis of mineral H₂O and hot spring water in Japan are given.

S. T.

Rehabilitation requirements of the Denver water-works. BURTON LOWTHER. *Eng. News-Record* 86, 859(1921).

FRANK BACKMANN

Report on industrial wastes from the stockyards and Packingtown in Chicago, Volume II, (1921), The Sanitary District of Chicago. LANGDON PEARSE. *Eng. News-Record* 86, 815-6(1921).—Final report on waste disposal of Chicago stockyards. Expts. on stockyards waste have been carried on for a period of 9 yrs. The waste is estd. to place a load on the Drainage Canal equiv. to the sewage of 1,000,000 people. Activated-sludge process is recommended. The analysis of the waste shows: Suspended solids, 281-506 p. p. m.; oxygen consumed, 150-269 p. p. m.; fats, 80-191 p. p. m.; and biochem. O demand, 834-1477 p. p. m. The night sewage is considerably weaker. In the activated-sludge process the consumption of air varies from 3.5 to 4.3 cu. ft. per gal. sewage with a detention of 8 hrs. Stabilities range from 41 to 71% with lower stabilities in winter. Screening with 20 or 30 mesh screens is desirable to remove coarser suspended solids. About 400 lb. dry screenings and 2300 lb. dry sludge were removed per mil. gal. sewage. By filter pressing, sludge may be reduced from 99 to 76% moisture. The expts. also included Imhoff tank-sprinkling filter and acid treatment, the results of which are detailed. Cf. C. A. 14, 3489.

FRANK BACKMANN

Pascale Valley sewage decision against New York. ANON. *Eng. News-Record* 86, 849-51(1921).—U. S. Supreme Court on May 2nd denied the application for an in-

junction against the discharge of sewage from the Passaic Valley Sewerage District into upper New York Bay. The claims of New York State that the discharge of the sewage into N. Y. Bay would create a public nuisance by causing odors or unsightly deposits on the surface were not proved to the satisfaction of the Court.

FRANK BACHMANN

The activated-sludge process of sewage disposal. GEORGE C. NASMITH. *Eng. News-Record* 86, 905-6(1921); cf. *C. A.* 14, 1173.—The advantages of the process are: (1) Simple construction; (2) as good an effluent as with any other process; (3) inoffensiveness; and (4) minimum amt. of pumping. The disadvantages are: (1) need of proper supervision; (2) interference of trade wastes and disinfectants; and (3) clogging of air blowers and filter plate.

FRANK BACHMANN

Disinfection of Japanese privies, urinals, sewage, and public baths: most practical methods for prevention and control of infectious disease. FUJIWARA. *Kyoto Igaku Zasshi* 16, No. 1, 146-67(1919); *Jap. Med. Literature* 6, 2-3(1921).—A study of the use of $\text{Ca}(\text{OH})_2$ and of chloride of lime plus crude HCl or H_2SO_4 as destroyers of pathogenic bacteria in excreta, and of petroleum as a destroyer of fly larvae. JOSEPH S. HEPBURN

Sulfur dioxide as a factor in the smoke problem of Salt Lake City. G. ST. J. PERROTT. Bureau of Mines, *Rept. of Investigations* No. 2128, 6 pp. (1920).—Analysis of samples of air taken under varying conditions and in various parts of Salt Lake City shows a maximum content of 0.8 part per million of SO_2 with an av. below 0.1 part per million. The highest concns. are found on smoky days, in the morning and in the business district. Combustion of fuel is responsible for most of the SO_2 , and the concn. is always a negligible factor in the smoke nuisance. W. H. BOYNTON

Some aspects of pollution as affecting oyster propagation. T. C. NELSON. *Am. J. Pub. Health* 11, 498-501(1921).—The nature and source of the oyster has caused it to receive the attention of many sanitarians. In this paper the effects of pollution on the oyster are considered. The same factors which destroy the oyster also destroy other life. Persons from all callings must take an interest in stream pollution. F. W. T.

Quality of irrigation water in relation to land reclamation (SCOFIELD, HEADLEY) 15. Basic exchange in silicates (RAMANN, JUNK) 6. Ground water in the Meriden Area, Connecticut (WARING) 8. Ground water in the Southington-Granby Area, Connecticut (PALMER) 8. Air pollution by smoke (RUSTON) 11D. The equivalent weights of several bases in permittite (GÜNTHER-SCHULZE) 2.

Purifying water. J. B. GAIL AND N. ADAM. *Brit.* 161,942, Apr. 7, 1921. To remove oil from H_2O of condensation the H_2O is treated with an alk. and an acid reagent which will react to form a metallic hydroxide that will envelope and carry down the oil. Na_2CO_3 and FeCl_3 are preferably used. A suitable app. is specified.

Extracting oils, fats and fatty acids from sewage. R. H. MCKEE. U. S. 1,376,211, Apr. 26. Sewage or similar material containing oil or the like to be extd. is dehydrated and then treated with liquid SO_2 as a solvent for the oily or fatty material.

Treating sewage. DORR CO. *Brit.* 161,164, March 5, 1921. Sewage is agitated or beaten to comminute the more nitrogenous solid matter, then strained and treated with activated sludge, while air is introduced in such a manner that it causes circulation of the liquid. A suitable construction is specified.

Purifying waste liquids. KOPPERS CO. *Brit.* 161,976, Apr. 11, 1921. Phenol-contaminated liquors, e. g., waste liquors from NH_3 stills, are filtered through humus material, such as peat, inoculated with microorganisms which will destroy the phenols. The humus material is preferably mixed with coke to prevent packing and allow of aeration. It is inoculated with the organisms by passing activated sewage sludge

through the filter or by allowing the liquor to pass through farm-yard manure placed above the filter. NH_3 -still liquor is dild. before passing through the filter, preferably with effluent from the filter. Cf. C. A. 14, 1894.

15—SOILS, FERTILIZERS AND AGRICULTURAL POISONS

J. J. SKINNER

Work of the Agrikulturchemischen Versuchsstation Halle a/S. W. SCHNIGDEWIND, D. MEYER, AND F. MÜNTER. *Landw. Jahrb.* 55, 1-21(1920); *Physiol. Abstracts* 5, 502-3(1920).—Comparative expts. were made with NaNO_3 , $\text{Ca}(\text{NO}_3)_2$, $\text{Ca}(\text{NO}_3)_2$ and urine on different kinds of soil during autumn and spring. The plants used were oats, turnips, and potatoes. Expts. were also made on the loss of the different forms of N in the surface dung. The results of the extensive expts. are summarized in lengthy tables. II. Phosphoric acid experiments. *Ibid* 21-40.—The expts. extended over 5 yrs: oats and beans were employed, and the investigations carried out on 3 different sorts of soil. The influence of P from "Thomasmehl" and superphosphate was detd. in reserve dung and yearly dung. If the soil contains Ca, "Thomasmehl" and superphosphate have approx. the same influence. Reserve dung on all 3 kinds of soil was sufficient. III. Potassium experiments. *Ibid* 40-6.—Comparative expts. were made with KCl, K_2SO_4 , phonolith, and lengitect. The effect of the last was nil. The sulfates of K and of Mg gave a better effect on turnips and potatoes. Expts. on the influence of NaCl dung before and after cultivation, and on the effect of increasing addition of NaCl, MgCl₂, and MgSO_4 were also made. Larger quantities of Cl salts have a harmful influence. IV. Calcium and magnesium experiments. D. MEYER. *Ibid* 46-62.—Expts. on the effect of different forms of Ca, with special consideration of the "Endlangenkalk." This showed a worse effect than burnt lime and carbonate of Ca. Investigations are described on the action of different relations of Ca to Mg on the yield. A surplus of Mg is better. Expts. on the effect of burnt lime and burnt Mg were also made. The harmful influence of burnt Mg was seen in the third year. The ratio between Ca and Mg can be altered within wide limits. V. Experiments on chemical and bacteriological changes in the soil. F. MCNTER. *Ibid* 62-139. Expts. are set forth on the influence of pure dung salts on chem. processes in the soil; on the soly. of phosphates; on the detn. of NH_3 in the soil; on the influence of the different kinds of soil and of the contents of water on the nitrogenous changes; on nitrogenous metabolism; on actinomycetes and their life and relations to the soil. VI. Bacteriological experiments. B. HEINZE. *Ibid* 139-84. On the importance of different bacteria for the nitrogenous metabolism of plants.

H. G.

The partial sterilization of soils. E. J. RUSSELL. *J. Roy. Hort. Soc. London* 45, 237-46(1920); *Physiol. Abstracts* 5, 508.—A general review.

H. G.

Effect of season and crop growth on the physical state of the soil. D. R. HOAGLAND AND J. C. MARTIN. *J. Agr. Res.* 20, 397-404(1920).—Aq. exts. of cropped and uncropped soils were prepd., 1 pt. of soil and 2 pts. of water being used. The concn. of this ext. was detd. by cond. measurements, and the colloidal matter in the soil estd. approx. by turbidity measurements after the soil had been allowed to settle in the water for 24 hrs. The results indicate that the physical state of certain soil constituents is influenced to a marked degree by the concn. of the soil soln. There is a considerable seasonal variation in the colloidal state of the soil suspension, and a large increase in colloidal matter is noted when the soil soln. is depleted as a result of absorption of solutes by the plant.

J. C. S.

Degree of temperature to which soils can be cooled without freezing. G. BOUYOU-

cos. *J. Agr. Res.* 20, 287-9(1920).—All mineral soils could be cooled to -4.2° and kept at that temp. indefinitely without freezing. Agitation of the soil however caused it to freeze at once. The amt. of water in the soil made no difference. Peat and "muck" could be supercooled to -5° . Some other materials, such as silica, carbon black, and gelatin, satd. with water, were tested also, and these could be cooled to -6° without freezing. The expts. show that in winter when the temp. of the soil falls only a few degrees below zero, the soil does not really freeze.

J. S. C. I.

The relation of the soil colloids to the thermal conductivity of the soil. T. BEDFORD FRANKLIN. *Proc. Roy. Soc. Edinburgh* 41, 61-7(1921).—The change in conductivity of clay loam with temp. is due to the colloids present in the soil rather than to the org. matter. This change in conductivity is probably brought about by the colloidal films surrounding the soil grains swelling with the rise in temp. and so automatically compacting the soil and reducing the transfer resistance to heat between the particles within the soil.

W. H. ROSS

Quality of irrigation water in relation to land reclamation. C. S. SCOFIELD AND F. B. HEADLEY. U. S. Dept. of Agr. *J. Agr. Research* 21, 265-278(1921).—A sample of Mesa sand from southwestern Arizona was leached with NaCl soln. followed by H_2O and the effect on the rate of percolation and on the character of the percolate was noted. A sample of almost impermeable soil from Fallon, Nev., was percolated with $CaCl_2$ and with mixts. of $CaCl_2$ and NaCl followed by H_2O , and the effect on the rate of percolation and character of percolate detd. Analyses are given of 19 important irrigation streams in Western U. S., showing the amts. of Ca, Mg and Na plus $\frac{1}{4}$ of the K, and the proportion of the sum of the Ca and Mg to the sum of the Na plus $\frac{1}{4}$ of the K. Analyses of Salt River H_2O from Arizona canal at Mesa, Ariz., and of Colorado River H_2O samples taken at Yuma, Ariz., are also given. The hardness or impermeability of certain irrigated land in the Western U. S. is believed to be due to the effect of the Na on the clay in the soil. It is difficult to wash out the excess of sol. salts that may be present in such soil in amts. sufficient to injure plants. In the presence of other bases such as Ca or Al in appreciable quantities and in sol. form the injurious action of the Na on the clay does not take place. When irrigation H_2O contains more Na and K than Ca and Mg there is danger that its continued use may cause the land to become hard and impermeable to H_2O . Some of the important irrigation waters of the U. S. are of this character. It is believed that the use of Ca or Al in sol. form applied either to the land or to the waters will remedy the trouble.

F. C. COOK

Nitrification in semi-arid soils. W. P. KELLEY. *Brasil Agr.* 4, 160-2, 202-5, 229-32, 251-4(1919); *Expt. Sta. Record* 43, 215-6.—California soils in general are able to nitrify the amts. of dried blood used in practice. Nitrification of 1.0% of dried blood was interfered with by 0.05% Na_2CO_3 , but that of 0.1% dried blood was not affected by 0.4% Na_2CO_3 . The presence of 0.1% Na_2CO_3 hindered the nitrification of 0.15% $(NH_4)_2SO_4$, but stimulated that of 0.0625% $(NH_4)_2SO_4$.

T. G. PHILLIPS

The amounts of nutrient substances abstracted from the soil by rice. Experiments in Java. C. VAN ROSSEM. I. The amounts of the principal nutrient substances abstracted from the soil by a rice crop. II. The amounts of nutrient substances abstracted from the soil by the rice plant at different stages of growth. *Mededeelingen van het Agricultuur-Chemisch Laboratorium* 1917, No. 17; *Bull. Agr. Intelligence* 10, 878-81.—I. The kg. of nutrients per hectare removed from the soil by rice are as follows for paddy, straw, and roots, resp.; N, 23.3, 22.0, 4.8; K_2O , 12.3, 50.6, 7.5; P_2O_5 , 12.1, 11.4, 1.5; Fe_2O_3 , 1.4, 42.7, 35.7; CaO , 1.5, 13.4, 3.0; MgO , 4.4, 5.6, 1.4; SiO_2 , 148.7, 939.1, 91.4. II. Samples of rice were analyzed at 5 stages of development, the first at about 55 days, the last at maturity. The results, based on 100 plants,

are presented in extensive tables. N, P_2O_5 , and K_2O are absorbed throughout the course of development, N and P_2O_5 more rapidly during ripening, K_2O less so.

T. G. PHILLIPS

Present position and future prospects of the natural indigo industry. W. A. DAVIS. *Agr. Research Inst., Pusa, Indigo Publication 2*, 18 pp. (1918).—Exhaustion of available P_2O_5 in the soil causes "wilt disease." Systematic P_2O_5 fertilization is necessary for successful commercial indigo growing.

H. W. EASTERWOOD

• **Notes on practical salt land reclamation.** G. S. HENDERSON. *Agr. Research Inst., Pusa, Bull.* 91, 16 pp. (1920).—Lands of Egypt and India containing sol. alkaline salts are successfully reclaimed by washing salts to the subsoil.

H. W. EASTERWOOD

A study of the indigo soils of Bihar. W. A. DAVIS. *Agr. Research Inst., Pusa, Indigo Pub.* 1, 75 pp. (1918).—Failures in indigo crops were found in almost every case to be due to lack of available P_2O_5 in the soil and subsoil (often less than 0.0002%). Comparative analyses show approx. one-hundredth as much available P_2O_5 now as in 1899. Just sufficient P_2O_5 is liberated in the early part of the year to permit growth of first crop whereas the second crop dies. Superphosphating increases yield of first crop 50%, second crop 100% and seed crop 300–400%.

W. H. EASTERWOOD

Utilizing soil potash by means of intermediary crops. A. W. BLAIR. *Proc. Soc. Prom. Agr. Sci.* 39, 69–74 (1919); *Expt. Sta. Record* 43, 218.—Soy beans, and perhaps some other plants, are able to use rather large amts. of soil potash when forced to do so. If supplied with available potash, they store up large amts. of it, with no corresponding increase in yield. Such plants should be used more widely to make the soil potash available.

T. G. PHILLIPS

Comparison of the effect of various types of open-hearth basic slags on grassland. G. S. ROBERTSON. *Trans. Faraday Soc.* 16, 291–301 (1920).—Field expts. were made on 3 different soils under grass which were deficient in phosphate. Three varieties of basic slag were used: a high-grade Bessemer slag with 92% of sol. phosphate (on total phosphate), low-grade basic slags with 80–93% of sol. phosphate, and open-hearth basic slags with 20–45% of sol. phosphate. The hay crop was found to be as heavy on land treated with an open-hearth slag of 45% sol. phosphate as on land treated with the high-grade slags, but open-hearth slags with sol. phosphate below this amt. gave much lighter crops. Clover crops were much increased by the application of open-hearth slag of 20% sol. phosphate, though the results were inferior to those with 90% sol. slags. A test of the citric soly. of the slags was made, using 1 g. of the sample instead of the usual 5 g. As a result, the citric soly. of the open hearth slags was increased to over 60%, while the other basic slags showed 90–100% soly. A Gafsa rock phosphate showed an increase from 38 to 89% soly. under the same conditions. In order to enable open-hearth basic slags of 5–8% phosphate content to be utilized as fertilizers it is suggested that they should be enriched during manuf. by the addition of rock phosphate to the molten slag in the ladle.

J. S. C. I.

Improvement of low-grade basic slag. W. S. JONES. *Trans. Faraday Soc.* 16, 324–7 (1920).—Basic slag may be improved in quality by washing on a concg. table and subsequently drying; in this way the phosphate content may be increased about 12%. By suitable tapping of the furnace, the slag may be sepd. into a richer and a poorer slag. Direct enrichment may be obtained by adding rock phosphate to the slag either in its molten condition or when cold before grinding. Frequently a low-grade slag is returned to the blast furnace with the next charge and its P taken up by the pig iron, from which it is obtained again in the Bessemer converter in the form of an enriched slag. The suggestion is made that the principle of the Bertrand-Thiel process might be utilized. In this process two furnaces are used, the pig iron being melted in the first without scrap before being run into the second contg. the scrap, etc. As no scrap is

used in the primary furnace, the slag is not diluted thereby, and a grade contg. a high percentage of P can be obtained.

J. S. C. I.

Effect of fluorspar additions on the phosphates in basic slag. F. BAINBRIDGE. *Iron Steel Inst. London, Carnegie Schol. Mem.* 1920, 1-40.—(I) (II). Fertilizer value of basic slag containing fluorspar. Continuing previous work (*C. A.* 14, 586), expts. were made to exam. the possibility of increasing the fertilizing value of insol. phosphate by adding it to the soil in the late autumn and thus exposing it during the winter to the action of the atm. The results showed a bigger proportionate yield compared with a sol. slag when the insol. phosphate was applied in the autumn instead of in spring. The insol. slag gave satisfactory yields of both grain and straw (barley), but failed to give the increased phosphate content of grain and straw given by sol. slag. III. Nature and solubility of the phosphates contained in basic open-hearth slag made with additions of fluorspar. In expts. to prep. synthetically the compds. presumed to be present in basic slag, uncombined lime in the fusions was detd. by passing steam over a weighed quantity of the material contained in a Pt boat in a silica tube heated to 140°, the gain in wt. being attributed to the hydration of lime. $\text{Ca}_3(\text{PO}_4)_2$ is much more sol. in 2% citric acid than in NH_4 citrate soln.; consequently the use of the latter solvent was abandoned. The fusion of the tribasic phosphate with CaF_2 caused a rapid fall in the soly. of the phosphate up to a point corresponding with 8 pts. CaF_2 to 100 pts. of phosphate. Tetra-basic Ca phosphate was prepd. by fusing the tribasic phosphate with lime in the oxy-acetylene blowpipe flame. The product contained 94.12% of tetrabasic phosphate and 0.9% of free lime. A soly. detn. showed that only 21.5% of the phosphate present was sol. when ground to 100-mesh, but 72.26% when ground to flour. The tetrabasic phosphate is decomposed when fused with CaF_2 , apatite being formed, with the result that the soly. is lowered. Silico-carnotite, $3\text{CaO} \cdot \text{P}_2\text{O}_5 \cdot 2\text{CaO} \cdot \text{SiO}_2$, was prepd. by fusing dicalcium silicate with $\text{Ca}_3(\text{PO}_4)_2$ and was completely sol. in citric acid. Fusion of silico-carnotite with CaF_2 rapidly lowered the soly. A number of fusions of basic slag with varying quantities of CaF_2 were made, and the products were analyzed and their solubilities detd. Curves are given showing the lowering effect on the soly. of the phosphate of increasing quantities of CaF_2 . It is concluded that the addition of CaF_2 to basic open-hearth slags results in the formation of an apatite of the formula $3(3\text{CaO} \cdot \text{P}_2\text{O}_5) \cdot \text{CaF}_2$. Crystals which were identified as apatite were actually obtained from such a slag. In extremely sol. basic slags the phosphate is probably present as silico-carnotite or steatite. Free lime does not exist to any extent in normally prepd. slag contg. about 14% P_2O_5 . Appendix. Effect of the addition of lime on the citric acid solubility of basic slag. The result of re-fusing a slag, without addition of lime, is to increase considerably the soly. of the phosphate present. Addition of lime does not affect appreciably the soly. of the phosphate, while the added lime combines, probably with the Fe oxide present, to form a compd. almost insol. in citric acid.

J. S. C. I.

Magnesium as a fertilizer. FELICE MASINO. *Ann. Accad. agr. Torino* 61, 95-100 (1918).—Mg should be given consideration, since chlorophyll is an organo-metallic compd. of Mg. Pot expts. with equal amts. of MgCO_3 and CaCO_3 showed larger yields from the MgCO_3 . Field expts. showed no beneficial effects with MgSO_4 in a soil containing gravel composed largely of calcareous limestone containing up to 14% MgCO_3 , but gave a 40% greater yield than the control on a soil composed mostly of decalcified clay poor in alk. earth carbonates.

ALBERT R. MERZ

Agricultural insecticides. R. R. HENDERSON. *Chem. Age (N. Y.)* 29, 167-8 (1921).—A review of the uses, economic importance and progress made in the manufacture of com. insecticides.

W. H. ROSS

Toxic action of compounds of arsenic, antimony, and fluorine on cultivated plants. A. WÖRNER. *Angew. Botanik* 2, 161-78 (1920).—A general toxic dose of a given poison

for phanerogams cannot be indicated, since marked differences are observed in the behavior of different plants towards the same poison. Scarlet runners and seedling peas are most readily affected, while barley, oats, wheat, maize, and rye are less sensitive. In water cultures, 0.01 g. of As_2O_3 per l. is strongly toxic, but the action of As oxide is less pronounced; 0.1 g. per l. is fatal to all plants. Sb is much less poisonous. NaF is harmful when present to the extent of 0.1 g. per l. When scattered on the soil, As_2O_3 is less toxic than As_2O_5 ; Sb_2O_3 is still less poisonous (0.5 g. per 100 g. of soil is necessary), and has about the same action as NaF. In 0.1% soln, As_2O_5 is more toxic than As_2O_3 when used for spraying the green parts of plants, but with the Na salts the order is reversed. Corrosive action is not exhibited by NaF solns. contg. less than 1% of the salt.

J. C. S.

Air pollution by smoke (RUSTON) 11D.

Acid-phosphate apparatus. R. E. FORBIS. U. S. 1,376,612, May 3. The pat. relates to structural features of a den for the manuf. of acid-phosphate.

Phosphate fertilizer. M. SHOELD. U. S. 1,375,115, Apr. 19. Dusting of wet pptd. $CaHPO_4$ is obviated by mixing it with H_2SO_4 or niter cake and drying the mixt.

Kerosene emulsion adapted for use as an insecticide. D. J. MURPHY. U. S. 1,374,755, Apr. 12. An aq. emulsion of kerosene adapted for use as an insecticide on trees is formed by the use of a relatively small amt. of the reaction products of KOH, oleic acid and stearic acid in H_2O .

Arsenical insecticide. W. MOORE. U. S. 1,376,153, Apr. 26. An insecticide adapted for use on plants is formed by reaction of Na arsenate or arsenite on $FeCl_3$, $AlCl_3$, $Cr_2(SO_4)_3$, Ce chloride or $Na_2Cr_2O_7$ or $K_2Cr_2O_7$ and washing the ppt. thus obtained.

Lime-sulfur fungicide and insecticide. D. S. PRATT. U. S. 1,374,951, Apr. 19. A dry lime-S compn. for use as an insecticide and fungicide is prepd. by spraying a lime-S soln. in the form of a fine mist into a heated chamber and withdrawing the vapor formed from the chamber. Fine particles with a high content of active material are thus obtained, a large part of which is sol. in cold H_2O .

Composition for preventing smut of grain. J. P. MINNE. U. S. 1,375,529, Apr. 19. A mixt. for treating grain to prevent smut is formed of lime 3 lbs., NaCl 8 oz., ashes 2 lbs., and H_2O 2 gals., heated together.

16—THE FERMENTATION INDUSTRIES

H. S. PAINE

Acetone fermentation process in India. G. J. FOWLER, Y. D. WAD, AND A. G. GOKHALE. *J. Ind. Inst. Sci.* 4, 1-15(1921).—As raw material for the acetone fermentation process, mahua flowers (*Bassia latifolia*), contg. 40-60% of total sugars, 0.65-1.1% of N and little or no starch, were tried under various conditions but gave very unsatisfactory results. Good fermentations were obtained, however, with starch contg. materials, such as rice, but jawari (cholam) flour was preferred on account of its cheapness. In small scale expts. 1200 g. of jawari flour contg. about 52% of starch and 1.2% N gave about 70 cc. of acetone and 128 cc. of butyl alcohol. The most vigorous fermentation took place with cultures only two or three generations from spores, and it is important to ensure that the cultures do not lose their power to sporulate, as they tend to do after continued subculture in simple maize mash. This was achieved by inoculating in a mash contg. meat ext., peptone, or gelatin. The chief difficulty in large scale work is the maintenance of sterility up to the point of inoculation; 4 hrs. heating

under 15 lb. steam pressure was found to be requisite. The problem of the disposal of the effluent, which amounts to 50,000 gal. per ton of acetone produced, was studied. A cake utilisable for cattle food is obtained by pressing the husk along with the sludge resulting from plain sedimentation. The turbid liquid remaining is clarified by treatment with excess of lime, and gives a further sludge which has valuable fertilizing properties. In connection with the above work rough expts. were made on the *flashing and explosive concns. of mixts. of acetone vapor and air*, indicating that a concn. of acetone vapor up to 2.3% was safe. The mixt. flashes above this concn., reaching a max. violence at a concn. of 5.61% of acetone and settling down to a quiet flame at 10.2% of acetone vapor.

J. S. C. I.

Fermentation of worts containing added sugars. J. O'SULLIVAN. *J. Inst. Brewing* 27, 93-100(1921).—Fermentations carried out with a large number of single-cell cultures prepd. from 3 brewery yeasts indicated no appreciable differences in fermenting power. In expts. with a malt wort of sp. gr. 1.061, treated with sucrose, invert-sugar, dextrose, or maltose equiv. to 15% of the extract present, and fermented with 0.2 g. of pressed yeast for 10 days at the ordinary temp., the whole of the added sugar, together with the fermentable matter of the wort, disappeared in all cases. In fermentations of solns. of the same concn., but contg. different proportions of fermentable sugars and the same quantity of nutrient matter, practically the whole of the fermentable sugars was fermented when the alc. produced did not exceed 5%, but beyond this alc. content some of the sugar remained unfermented.

J. S. C. I.

The active principles of grape wine. T. G. KOOTALADSE. *Russ. Physiol. J.* 2, 1-14(1919); *Physiol Abstracts* 5, 484.—Comparative expts. were performed upon the isolated mammalian heart with grape wine and alc. The alc. (0.1 to 2.0% solns.) decreased the rate of the beat and markedly diminished its strength. The grape wine diluted to the same concn. of alc. increased the rate by about 20%, doubled the output and the strength of the beat, and increased the amt. of fluid passing through the coronary vessels. A substance was isolated from the residue left after the distn. of the wine; it had a brown color and a bitter taste, was insol. in ether, CHCl_3 , and benzene, very sol. in alc. and water. This substance in a 1:500,000 concn. had a powerful effect on the isolated heart. Its effect is not like that of digitalis; it seems to increase the abs. strength of the heart and revive even the exhausted and dying heart. As to the chem. compn. of this substance, it is classified as an amine on the ground of the method of its isolation. The fresh grape juice does not contain this substance; it is formed only in ripening of the wine, and is a product of fermentation. Ordinary light wine contains about 0.0137% of this active principle. The presence of this substance and its powerful action on the isolated heart may be used for the detection of adulterations of wine.

H. G.

Simplification of the Lintner-Wirth method for determining the diastatic power of malt. G. ROEDER. *Woch. Brau.* 38, 5-7(1921).—The procedure suggested comprizes the same operations as in the Inst. of Brewing Comm. method (*J. Inst. Brewing* 12, 1-10(1906)), but the malt ext. is allowed to act on the starch soln. for $\frac{1}{2}$ hr. at 17.5° instead of 1 hr. at 70° F. (21° C.), the reducing sugar is detd. by Kjeldahl's gravimetric method, and the diastatic power is expressed as g. of maltose per 100 g. of malt.

J. S. C. I.

Estimation of the extract of colored malts. C. G. MATTHEWS. *J. Inst. Brewing* 27, 22-5(1921); *Analyst* 46, 95-6.—The following method is advocated for the analysis of "crystal" and black malts in preference to that adopted by the Institute of Brewing, Malt Analysis Committee (*J. Inst. Brewing* 12, 6(1906)), on the grounds that the latter method requires much time, a large quantity of standard malt, and tends to yield low results, besides giving variable exts. in the hands of different analysts: Forty g. of standard malt, having a diastatic power between 35 and 45° Lintner, are ground in a

Seck mill set to 25° and mixed with 10 g. of the malt under examn. ground in a similar manner (black malts may also be ground in a coffee-mill without any effect upon the final result). The mixt. is mashed, cooled, and filtered according to the Committee's method, and the ext. and color are detd. in the usual manner by appropriate calcn. The use of a standard malt having a diastatic power above 55° Lintner yields abnormal results by both methods. Four tables giving the results of expts. obtained with different malts and with various modifications of method indicate that the procedure recommended by M. is reliable.

H. G.

Harvesting, storage and drying of barley. A. CLUSS, W. KLUGER, AND V. KOUDELKA. *Z. ges. Brauw.* 1921, 4-18.—Expts. similar to those of 1913 (*C. A.* 15, 2133) were carried out in 1914. The 1914 barley was drier and richer in starch and ext. than the 1913 crop, and its germinative power developed much more rapidly. By deferring the harvesting of the grain until it was "dead ripe" the brewing quality was improved. The advantages of drying the grain artificially, although well marked, were much less so than in the case of the previous crop.

J. S. C. I.

Drying of hops. A. H. BURGESS. *J. Inst. Brewing* 27, 180-4 (1921).—Eleven kilns of various types were visited and records were made of 15 oastings. The time taken to dry hops does not depend solely on temp., depth of load, and moisture content of the hops. Hops wet with rain dried in some cases as rapidly as those picked in fine weather, and some oastings at comparatively high temps. dried more slowly than others worked at a lower temp. The most important factors are probably temp. and air supply, but the latter could not be estd. with any approach to accuracy.

J. S. C. I.

Maize and rice and the method of using them (in brewing). W. WINDISCH. *Woch. Bran.* 38, 9-15 (1921).—In view of the fact that German brewers are now permitted to employ maize grits, free from husks and embryos, and also rice products unsuitable for human consumption, W. gives an account of the compn., method of production, and brewing properties of these adjuncts, and also discusses the manner in which they may be employed in brewing. Some expts. on the malting of maize are also described.

J. S. C. I.

Break of yeasts. H. LÜERS AND R. HEUSS. *Z. ges. Brauw.* 1921, 18-22.—The flocculation or "break" of yeast, in aq. suspensions, is closely related to the viscosity of the suspensions. Ca or Ce chloride increased the viscosity and promoted flocculation to a much greater extent than equimol. proportions of KCl. The viscosity of 12% suspensions of washed living yeast varied greatly with the reaction of the liquid, attaining a very well defined max. point when the reaction was slightly acid (p_H = about 4), and this point corresponded also with the max. of flocculation. Similar suspensions of yeast killed by $CHCl_3$ or heat showed no flocculation, and their viscosities were relatively low and varied to only a slight extent with the reaction of the liquid.

J. S. C. I.

The utilization of "Sump" (AMMANN) 27. A study on rice from the Cameroons (HEIM, HUSSON) 12.

Alcohol and potassium compounds from molasses. M. C. WHITAKER. U. S. 1,376,662, May 3. Cane molasses, dild. with 5 times its wt. of H_2O which may be acidified with H_2SO_4 , is treated with 0.06% of 30% H_2SiF_6 and then subjected to alc. fermentation. The presence of the H_2SiF_6 does not interfere with the fermentation nor ppt. K compds. but serves to prevent undesirable fermentations because of its bactericidal action. The slop remaining after the production and distn. of the alc. is treated with additional H_2SiF_6 sufficient to ppt. the K and the sepd. ppt. may be treated with H_2SO_4 to obtain K_2SO_4 . The latter may be purified by recrystn.

Mashing process. H. E. DECKEBACH. U. S. 1,374,191, Apr. 12. A ground malt mixed with the usual proportion of H_2O is heated in a mash tun to about 37° . At the same time grits composed of corn or rice are brought to a boiling temp. in a converter. Material is then pumped from the bottom of the mash tun to the top of the material in the converter and at the same time material from the bottom of the converter is led in upon the top of the material in the mash tun. A circulation in this manner is maintained until the starch is converted into sugar or, if a high degree of dextrin is desired, the circulation may be continued until a temp. of 75° is attained. Any unconverted malt will be retained at the top of the mash tun and may be removed with the spent malt.

Beverage from malted coffee or cocoa. F. W. GRAFF and J. V. OPPEL. U. S. 1,376,870, May 3. Green coffee or cocoa beans are allowed to germinate to form a malt, an extract is prepd. from the malt, fermented with yeast and the fermented malt extract is desiccated, roasted and the roasted product is fermented in soln. and carbonated to form a beverage.

17—PHARMACEUTICAL CHEMISTRY

W. O. EMERY

Sensitive test for the hydrides of arsenic, antimony and phosphorus by means of gold chloride. W. ZIMMERMANN. *Apoth. Ztg.* 36, 26(1921); *J. Chem. Soc.* 120, II, 276.

—Basing his expts. on Leibert's observation that $AuCl_3$ is reduced by AsH_3 , the author has shown that a drop of $NaAuCl_4$ soln. spread on a piece of filter paper is scarcely affected by pure H, but is colored violet by small amts. of the hydrides of As, Sb or P. A distinct coloration was obtained with 0.00284 mg. As in liquor kali arsenicosi in 2 min., and a recognizable reaction with 0.00015 mg. As in salvarsan in 10 min.; distinct and slight reactions were observed with 0.00124 mg. Sb in K Sb tartrate in 5 min., and with 0.25 mg. P in Ca hypophosphorousum, resp. Organic matter must be destroyed; H_2S interferes with the reaction by giving a brown coloration. W. O. E.

Cause and composition of the insoluble deposits in oil of mustard. H. KUNZ-KRAUSE. *Arch. Pharm.* 259, 16-33(1921).—Both natural and synthetic oil of mustard becomes discolored on keeping, and deposits a dark orange to citron-yellow material, consisting of a cauliflower-like mass made up in part of colorless quadratic prisms and hexagonal plates, cubes and needles. A portion of this ppt. sol. in H_2O consists chiefly of allylamine sulfate admixed possibly with traces of $(NH_4)_2SO_4$. The H_2O -insol. portion consists in the main of ψ -thiocyanogen, $C_3HN_3S_2$, accompanied possibly by isoperthiocyanic acid and allyl-substituted carbamides. A plausible explanation of the formation of these deposits is the following. Oil of mustard usually contains varying quantities of CS_2 and C_3H_5CN ; the changes in color and compn. are most likely consecutive reactions. The first change would involve decompn. of allylthiocarbimide into C_3H_5CN and free S, other mols. being dissociated into S:C: and $:NC_2H_5$ groups. Some of the free S dissolves in allylthiocarbimide, producing the initial yellow color of the oil, while a 2nd portion unites with the S:C: group to yield CS_2 ; a 3rd portion finally is oxidized to H_2SO_4 , which enters into combination with $C_3H_5NH_2$ resulting from the $:NC_2H_5$ groups. These last 2 reactions are due to the joint action of moisture and atmospheric O, catalytically accelerated in the presence of light by unchanged oil, which in turn becomes more or less polymerized during the process. The group S:C: is apparently fundamental in the formation of xanthic acid derivs., thus: $S:C: + S:C: -> NC_2H_5 + H_2O = HSCSOC_2H_5 + HCN$, the HCN so liberated polymerizing and then reacting with S to yield ψ -thiocyanogen, $3HCN + 3S = C_3HN_3S_2 + H_2$. The H thus liberated converts the group $:NC_2H_5$ to $C_3H_5NH_2$. W. O. E.

Active constituents of shepherd's purse (*Capsellae bursae pastoris*). H. BORUTTAU AND H. CAPPENBERG. *Arch. Pharm.* 259, 33-52(1921).—A physiol. study of the exts. of this drug indicated the presence of a substance inducing very marked depression in blood pressure, as also a product pptd. on the addition of HgCl_2 to the ext., which produces rise in blood pressure. This latter substance is very likely tyramine, although it could not be identified with certainty on account of the small quantity available, a condition likewise militating against the identification of any alkaloidal material possibly present. Histamine is probably absent. A description is given of the isolation of choline and acetylcholine from liquid exts.; these bases are also directly obtainable by pptn. with alc. PtCl_4 without prior treatment with Pb, Hg or Ba salts. Evaluation of the ext. is accomplished in the following manner: Mix 5 cc. of the ext. (1:1) with 12 cc. alc., then treat with 20-25 cc. 1% PtCl_4 soln. Let stand 2 days, filter the ppt., dry and ext. on the filter with hot H_2O . Evap. the filtrate in a tared dish. Filter the concd. filtrate if necessary, or if it becomes turbid, ppt. with 70% alc. A good sample of the drug should yield at least 0.2 g. of the PtCl_4 compd. Test the purity of this product by the m. p. or by estn. of N or Pt.

W. O. E.

Remijin, an inferior Japanese substitute for optochin (ethylhydrocupreine). C. A. ROJAHN. *Ber. pharm. Ges.* 31, 37-8(1921).—A sample of this product made by the Sankyo Co. of Tokyo, and described as Et hydrocupreine, gave on examn. the following results: light gray powder insol. in H_2O , sintering 105° (optochin 122°), m. $130-40^\circ$ (optochin $126-30^\circ$), loss on drying 2.7%, ash 0.27%, ethoxyl 8.94%, Et_2O ext. 65.41%, non-ethylated phenolic base 30.85%; thus it corresponds to about 67.5% of the ethylated base, the other third consisting of hydrocupreine, which differs physiologically from the Et deriv.

W. O. E.

Yield and composition of wormwood oil from plants at various stages of growth during successive seasons. F. RABAK. *J. Ind. Eng. Chem.* 13, 536-8(1921).—The investigation permits the following conclusions: (1) The yield of oil from the fresh herb during its flowering stage varies greatly from year to year, owing entirely to varying climatic conditions. Low pptn. coupled with high temp. and much sunshine affects the yield of oil favorably, while converse conditions cause a lower yield. (2) Drying of the plants before distn. invariably causes a reduction in the yield of oil, but apparently promotes esterification. The ester constituents from the fresh herb over a period of years appear to be in closer conformity than the alc. constituents. (3) The highest yield of oil is obtained during the flowering period. Soly. of the oil in alc. apparently is a criterion of the % of esters present. Likewise, sp. gr. bears a close relationship to the ester content. The alc. constituents decrease as the plant approaches maturity.

W. O. E.

Synthetic drug analysis. VIII. Estimation of salicylates and phenol. W. O. EMERY. *J. Ind. Eng. Chem.* 13, 538-9(1921).—Advantage is taken of the characteristic behavior of phenol and salicylic acid toward I, the final product of such action being in the presence of alkali or alkaline carbonates, a purplish red amorphous compd. (cf. Lautemann, *Ann.* 120, 309; Kekule, *Ibid* 131, 221; Kaemmerer and Benzinger, *Ber.* 11, 557; Bougault, *J. pharm. chim.* [6] 28, 147) having the compn. $\text{C}_6\text{H}_3\text{I}_2\text{O}$, and variously termed diiodophenylene oxide, tetraiodophenylene oxide or tetraiodophenylene quinone. It can be readily filtered and washed in a gouch, dried and weighed in the usual way.

W. O. E.

Poisons and their history. H. PETERS. *Pharm. Ztg.* 66, 407-9, 433-4, 457-9 (1921).

W. O. E.

Cresol soap solutions of commerce and the apothecary. C. ARNOLD. *Pharm. Ztg.* 66, 427(1921).—Attention is called to wide variations in cresol, soap and H_2O content of preps. available during the war period and later, amounting in the case of cresol

to 15-50%. Of 21 preps. 7 contained no soap at all. In view of these findings, the consumer is recommended to purchase only brands of established merit, preferably those manufd. under chem. and bacteriol. control.

W. O. E.

Preparation of catgut. F. J. W. PORTER. *Chem. News* 122, 245(1921).—A procedure is described for medicating catgut with HgI₂.

W. O. E.

Composition of Mexican cinchona bark. ANON. *Rev. agr. (Mexico)* 4, Nos. 5 and 6, p. 223(1919); *Bull. Agr. Intelligence* 10, 1146.—Analyses, made by V. Castellanos Quinteros, of samples of bark of red cinchona collected in Cordoba (State of Vera Cruz), gave the following results, in %: Total alkaloids 5.133, including: quinine 2.108, cinchonidine 0.060, quinidine 0.015, cinchonine 1.912, unestd. alkaloids 1.037. These barks were not gathered at the period when they are richest in alkaloids, viz., shortly before flowering time. Hence the Mexican product surpasses all the more the South American, which contains 4 to 5% alkaloids, and it bears comparison with grey cinchona which contains 5-6%.

H. G.

Report on work done at the Java cinchona experimental station in 1916-1917. ANON. *Mededeelingen Kina-Proefstation* (N. V. Bandoeng) 1918; *Bull. Agr. Intelligence* 10, 905-6.—Investigations are described regarding: the morphology of the flower and fruit of cinchona; the influence of moisture and air on the germination of cinchona seed; injury to cinchona seed freshly sown in nurseries by insect attacks. This last investigation was carried out by Dr. Bernard, Director of the Exptl. Station for tea. He noted that various species of mites can be very harmful, a fact hitherto unknown. Lastly, the commencement of an investigation regarding the influence of the drying temp. on the alkaloid content of the bark is described.

H. G.

Some medicinal plants of the Philippine Islands. L. M. GUERRERO. *Proc. Manila Med. Soc.; Philippine J. Sci.* 13, Sect. B, No. 2, 123-4(1918); *Bull. Agr. Intelligence* 10, 905.—The flora of the Philippines is rich in pharmaceutical plants which the natives use largely and which deserve to be scientifically studied with a view to their possible use in pharmacy. Among them G. notes: *Alstonia scholaris* used as a febrifuge and sometimes as a cardiac remedy; *Limasia amara*, employed as a gastric sedative; the seeds of *Quisqualis indica* employed as a vermifuge; *Tylophora brevipes*, similar to *Tylophora asthmatica* of India, which contains an alkaloid, tylophorine, and which is used as an emetic, antidiarrhetic and expectorant; *Tinospora reticulata*, used against malaria and which probably contains berberine.

H. G.

Proposed standard for goldenseal (*Hydrastis*) root. ANON. U. S. Dept. Agr., Bur. of Chemistry, *Service and Regulatory Announcements* No. 26, 14; *Analyst* 46, 143 (1921).—As a result of the examn. of com. *Hydrastis* root (in both whole and powdered condition) it is considered that the total ash should not exceed 8%, and that the acid-sol. ash should not exceed 3%.

H. G.

Substitution of flowers of *Onoperdon* species for saffron. ANON. U. S. Dept. Agr., Bur. of Chemistry, *Service and Regulatory Announcements* No. 26, 14; *Analyst* 46, 144(1921).—The flower-tops (corolla, stigmas, and anthers) of the "cotton" or "Scotch thistle" (*Onoperdon* sp.) dyed with tartrazine or com. Ponceau 2 R., and weighted with borax, KNO₃ and glycerol have been substituted for saffron (*Crocus sativus* L.). Saffron has a tri-lobed stigma, does not contain anthers or corollas, and imparts a characteristic coloration to water (1 to 100,000), or greater diln.). *Onoperdon* has tubular florets (which are much longer than the stigmas of saffron), stamens which show a narrow extension above the anthers, corollas with club-shaped multicellular glandular hairs, and pollen with a peculiar thickened triangular coat. Artificial dyes can be detected by the pink or red coloration with org. solvents, and added salts by the high total ash.

H. G.

Mustard seeds and substitutes. 1. Chinese colza, *Brassica campestris chinol-*

fera, Viehoveer. ARNO VIEHOEVER, JOSEPH F. CLEVENGER, AND CLAUDE OLIN EWING. *J. Agr. Research* 20, 117-40(1920); cf. *C. A.* 14, 3541.—A botanical and chem. study of seeds of *Brassica campestris chinoleifera*, Viehoveer, sold as mustard seed. The volatile oil obtained from these seeds was identified as crotonylthiocarbimide, which is not a suitable substitute for mustard oil, in respect to condimental, bactericidal, or medicinal value. J. C. S.

Hyoscyamine. J. HENRIKSSON. *Svensk Farm. Tid.* 25, 217-225(1921).—The culture, harvesting, and protection of *Hyoscyamus niger* L. are discussed. The alkaloid content of the stems of the leaves was the same as that of the flat parts of the leaves. The samples were of the first years growth. There is no appreciable difference in the per cent of hyoscyamine between the first and second years. A. R. ROSE

Hesperidine-like substances in the Umbelliferae. HAROLD NILSSON. *Svensk Farm. Tid.* 25, 233-8(1921).—The paper gives a brief résumé of the chemistry, properties and tests for hesperidine. Microscopic sections are best made after fixing with lactic acid and freezing. Microscopically the alkaloid is detected as spherocrysts and sheaves. These are sol. in pyridine and quinoline. Seventy specimens were examd.; either the spherocrysts or sheaves were noted in the leaves and stems of the following: *Angelica archangelica*, *A. atropurpurea*, *A. decurrens*, *A. litoralis*, *A. silvestris*, *Aethusa cynapium*, *Bubon galbanum*, *Conium maculatum*, *Ferula communis*, *F. neapolitana*, *F. scorodosma*, *Imperatoria ostruthium*, *I. hispanica*, *Libanotis siberica*, *Ligusticum scoticum*, *Sesili glaucum*, *S. tenuifolium*, *Trinia vulgaris*. The presence of the alkaloid was also confirmed by chem. tests. In the 4th, 6th, 8th there was also a positive test for the fruit. The following do not contain a hesperidine-like alkaloid: *Aegopodium podagraria*, *Anni majus*, *Anetum graveolens*, *Angelica verticillaris*, *Anthriscus silvestris*, *Apium graveolens*, *Asthranthia majus*, *Athamanta althaeifolia*, *Bupleurum aureum*, *B. longifolium*, *B. rotundifolium*, *Bifora tereticaulata*, *Carum carvi*, *Cherophyllum aromaticum*, *Ch. aureum*, *Ch. temulum*, *Ch. vilarisii*, *Cicuta virosa*, *Daucus carota*, *Eryngium maritimum*, *E. multifidum*, *Falcaria rivinii*, *Ferula ferulago*, *Foeniculum vulgare*, *Heloscandium inundatum*, *Heracleum sibiricum*, *H. villosum*, *Hydrocotyle asiatica*, *H. vulgaris*, *Laserpitium labi-folium*, *L. panax*, *Ligusticum levisticum*, *L. pyrenaicum* (var. *alpinum*), *Meum athamanthicum*, *Myrrhis odorata*, *Pachypleurum alpinum*, *Pastinaca sativa*, *Petroselinum sativum*, *Pencdanum oreoselinum*, *P. palustre*, *P. sulcatum*, *Pimpinella saxifraga*, *Sanicula europaea*, *Selinum carvifolia*, *Scandix brachycarpa*, *Sc. pecten*, *Silaua parietensis*, *S. sisaroidem*, *Sium latifolium*, *Torilis anthriscus*, *Oenanthe phellandrium*. In 1883 Borodin examd. 3000 plants and found the typical spherocrysts of alkaloid in the following list but made no chem. tests. The detail of this work is available only in Russian. *Conium maculatum*, *Trinia kitaibelii*, *Tr. hoffmanni*, *Tr. henningii*, *Athamanta cretensis*, *A. compacta*, *Libanotis montana*, *L. candollei*, *L. sibirica*, *Lomatopodium platyphyllum*, *Sessili gouvani*, *Cachrys pterocladia*, *Chritimum maritimum*, *Aethusa cynapium*, *Haloscias scoticum*, *Callisace dahurica*, *Angelica silvestris*, *Archangelica officinalis*, *Pseudanum arenarium*, *Laserpitium hirsutum*. A. R. ROSE

A general method for making quantitative microanalyses of vegetable drugs. ALBERT SCHNEIDER. *J. Am. Pharm. Assoc.* 9, 1140-53(1920).—Quant. microanalytical methods are based for the most part upon the fact that certain tissues and tissue elements are quant. fairly const. in plant organs and in products made from them. The chief difficulty in formulating definite quant. working methods in microanalysis is the lack of available data upon which to base standards for comparison. For example, if records of the starch content of ginger, apple, belladonna root, aconite root, colchicum corni, etc., were available for each month of the growing season, the starch factor might be used in detg. whether the respective articles were collected too early; or if a descriptive record of the development of the pollen grains of insect powder were available, it would

be possible to det. the % of over-ripe flowers in that drug. It is particularly desirable that microanalytical methods be developed because in many cases chemical methods are unknown or inapplicable. General directions are given for collecting the sample, grinding or powdering it, mixing the powdered drug, making dild. suspensions and conducting the counts. The technic applicable to a number of drugs, such as cinchona bark, comp. licorice powd., insect flowers and digitalis leaves, is described in detail. The anatomic structures for 78 drugs are listed but the quant. relationships of these structures remain to be detd. in most cases.

L. E. WARREN

By-products of forest industries (GROUD) 22.

BENNETT, REGINALD R.: *Materia Medica and Pharmacy for Medical Students, with an Appendix on Incompatibility*. 4th Ed. London: H. K. Lewis & Co. Ltd. 264 pp. 7s. 6d. net. For review see *Pharm. J.* 106, 491(1921).

Double nitrate of aluminium and potassium. N. M. LAPORTE. U. S. 1,377,081, May 3. A double nitrate of Al and K of the formula $\text{Al}(\text{NO}_3)_3 \cdot 3\text{KNO}_3 \cdot 10\text{H}_2\text{O}$ is made by crystn. from a soln. of KNO_3 and $\text{Al}(\text{NO}_3)_3$ in HNO_3 . The proportions of the KNO_3 and $\text{Al}(\text{NO}_3)_3$ may be somewhat varied. The salts have astringent, leucocytotic and phagocytotic properties.

18—ACIDS, ALKALIES, SALTS AND SUNDRIES

F. C. ZEISBERG

The intensive manufacture of chamber acid. A. G. DURON. *Industrie chimique* 8, 222-3(1921).—Criticism of Cochet's article on the Benker-Millberg system (*C. A.* 15, 1602). The use of 2 head chambers originated with Hasenclever in 1902 and as early as 1909 their use was discontinued by Hartmann-Benker (Wiesbaden). The yield from any properly designed chamber system is as great as with the B.-M. Though the deterioration of the Pb of the head chambers is reduced, that of the tail chambers is increased. The use of 2 small tail chambers was known in 1876.

A. P.-C.

Methods of supplying lead chambers with nitric compounds. GIUSEPPE GIANOLI. *Giorn. chim. ind. applicata* 3, 11-2(1921).—G. discusses the new methods of supplying nitric compds. to the Pb chambers, i. e., introducing a concd. aq. soln. of NaNO_3 into the Glover tower, or directly into the Pb chambers. Details of arrangement are given and data showing saving of HNO_3 brought about.

ROBERT S. POSMONTIER

Ammonia oxidation at Höchst. J. R. PARTINGTON. *J. Soc. Chem. Ind.* 40, 185-7R (1921).—A very condensed description, full of detailed numerical data, of the ammonia-oxidation, nitrogen oxide absorption and nitric acid concg. plants at the Höchst Farbwerke (vormals Meister, Lucius & Brünig). These plants represent the most advanced German practice. The capacity is 140,000 tons HNO_3 per year. A circular 20" Pt gauze of 80 mesh weighing 333 g. is used as catalyst in a cast-iron converter of 1.5 tons HNO_3 per 24 hr. capacity with an oxidation efficiency of 89%. From NH_3 to dil. HNO_3 the conversion efficiency is 87% and from NH_3 to concd. HNO_3 84%. The entrance gas to the converters is preheated by exchange with the exit gas. The NH_3 content is 13.5%. The nitrous gas is quickly cooled to throw out water, which is used on the absorption system, and is then passed to the towers which are 41 ft. high x 21 ft. internal diam., of brick filled with stoneware rings. Eight towers constitute a set, 50% HNO_3 being obtained from the first 6, over which water is circulated, while Na_2CO_3 soln. is circulated over the last 2 to form NaNO_3 . The acid pumps are chrome steel,

circulating 110 gal. per tower per min., a ribbed disk turning at 80 r. p. m. being used as distributor. The circulating as well as advancing acid is cooled in silicon iron S bends. The tower acid is concd. by mixing 7 parts tower acid with 1 part sulfuric acid (this seems an error, 1 part 50% HNO_3 probably being mixed with 7 parts sulfuric acid and denitrating. In France 2.5-3.0 parts sulfuric acid are used, but the acid obtained is less concd.—only 85%. It is interesting to see that the German technologists had reduced to practice many of the independent findings of the Munitions Invention Department of Great Britain.

F. C. Z.

Studies upon sampling of nitrate fields. I. Occurrence in the ground. ENRIQUE BRIEBA. *Caliche* 1, 4(1919).—The various theories of nitrate formation, namely, that of attributing its formation to atm. agents working on feldspars and other substances, that of Moeller supposing the decompn. of marine plants, that of Muntz and Plagemann which suggests an org. nitrifying ferment, that of Ochsenius based on the action of guano on Na_2CO_3 , all offer objections of greater or less degree and indicate that the deposits are of more complicated genesis than up to the present has been explained. The deductions from these theories taken in conjunction with the known facts regarding seepage, capillarity and ground water conditions make it possible to give generalizations regarding the location of nitrate deposits and their character which are of decided use in examinations. II. Distribution and boring of prospect holes. *Ibid* 47.—Relates to the details of examination and assay of nitrate deposits. III. Sampling and measuring the thickness of the veins. *Ibid* 88. IV. Topographic details and location of blast holes. *Ibid* 135. V. Tabulation and arrangement of data. *Ibid* 178. VI. Calculation of nitrate contents of the ground. *Ibid* 178. VII. Calculation of losses of nitrate during mining and treatment. *Ibid* 247.—The direct losses in mining nitrate vary from 5% for caliches of appearance very distinct from the waste material to 20% for caliche of the same aspect and physical properties as the waste. In cartage the losses will average around 2%. At the treatment plant the losses are variable depending on the assay of the caliche treated; but it is customary to say that the ripios should go out carrying not more than 5% nitrate. Lower ripios indicates exceptional work and higher ripios bad work. Other losses in the treatment plant may be considered as 1% of the nitrate on the cancha. VIII and IX. Calculation of minimum assay to be considered in estimating reserves. *Ibid* 295 and 347.—Details of material costs, operating costs, wages, salaries and labor required in mining and manuf. of nitrate and the detn. of the minimum grade of nitrate-bearing material that can be worked. X and XI. Determination of contents and superficial areas of nitrate grounds. *Ibid* 383 (1920).

C. L. BURDICK

The Chilean nitrate industry. ALJANDRO BERTRAND. Paris. *Imprimerie de Vangirard* 1920.—An elaborate and complete report on the technology and economics of the Chilean nitrate industry prepared originally for Messrs. Guggenheim Brothers of New York and printed by permission.

C. L. BURDICK

The Chilean nitrate industry. Its technology and economics. J. B. HOBBSBARN. *Caliche* 2, 485(1921).—Review of the above report. The reserves of exploitable nitrate are estimated at 335,800,000 tons in material ranging from 45% down to 8% nitrate contents. A main problem in the future of the nitrate industry is to develop a process which will be capable of treating caliches of 8 to 10% nitrate contents in which case enormous improvements in the methods of mining and handling the material can be achieved. The reviewer outlines as the newer proposed processes for nitrate recovery which merit technical consideration the following: (1) Hot leaching with evaporation (GRILLO-PERRONI); (2) hot leaching without evaporation (ALMEYDA, JUNQUERA, GABELLA, etc.); (3) cold leaching of the finely crushed caliche with evaporation (GUBBS, PRACHE-BOUILLON); (4) cold leaching of coarse crushed caliche with

evaporation (MASON); (5) hot leaching with filtration (BUTTERS); (6) hot percolation leaching without evaporation (BELLAVISTA); (7) hot percolation leaching with evaporation (DUVIEUSART); (8) cold leaching without percolation or evaporation (OSSA).

C. L. BURDICK

The Chilean nitrate industry. ANON. *Caliche* 2, 283(1920).—Review of the industry for the fiscal year ending June 30, 1920. During this period the world consumption of nitrate was 1,913,000 metric tons, over 50% of which being in the United States alone. The annual capacity of the nitrate plants in Chile is stated to be 83, 500,000 quintals (48 kg.) but it is doubtful if the industry could produce steadily at a rate more than 60,000,000 quintals (2,715,000 metric tons). The cost of production has fluctuated between 9 shillings and 10 shillings f.o.b. nitrate port tax paid. The corresponding average sales price for present and future sales has been around 15 shillings per quintal.

C. L. BURDICK

Nitrate technology. L. PERRONI. *Caliche* 2, 97(1920); cf. C. A. 15, 1968.—In the recovery of NaNO_3 from very low-grade caliches it is highly probable that a single process will not be universally applicable because of the very variable compns. of the caliche in sol. impurities. Microscopic examn. shows that in some instances NaNO_3 does not exist in the caliche as such but in some unknown chemical combination with other components of the caliche. The same is true of other of the sol. components commonly regarded as simple salts. In the Shanks process working on present day caliches assaying around 16% and relatively low in other sol. salts these compds. if present do not cause difficulties.

C. L. BURDICK

Nitrate technology. L. PERRONI. *Caliche* 2, 241(1920).—A descriptive analysis of the technology of the Chilean nitrate industry in its early days and at the present time.

C. L. BURDICK

The process of the Intercontinental Industries Inc. for the manufacture of nitrate. ANON. *Caliche* 3, 13(1921).—The process consists in treating the crushed caliche by percolation with moderately hot solns., evapn. of the solns. to satn. in multiple-effect evaporators and crystn. of the nitrates by cooling. The steam for all heating purposes is furnished by the exhaust from the high-pressure engine furnishing the power for transportation and manufacturing operations.

C. L. BURDICK

The Gibbs process at the Oficina "Celia." J. B. HOBBSAWN AND J. L. GRIGIONI. *Caliche* 2, 535(1921).—Recapitulation of the 3 years' work carried out at the Oficina Celia, giving the comparative details of operation of the Gibbs process of nitrate manuf. and the Shanks process. It has not been found possible to put the Gibbs process (cold or tepid leaching by agitation followed by evapn.) into complete independent operation but as an auxiliary to the Shanks process it is believed to be of value.

C. L. BURDICK

Technical notes. L. PERRONI. *Caliche* 2, 289(1920).—Analysis of the reasons for the failure of the Grillo-Perroni process for nitrate manufacture (hot leaching with evaporation). The chief troubles lay in faulty mechanical construction and in the inadequate provisions against iodine corrosion in the evaporators.

C. L. BURDICK

Analysis of nitrate manufacture. E. ALMEYDA ARROYO. *Caliche* 2, 109, 159(1920); cf. C. A. 15, 2156.—A discussion of the factors limiting the rate of dissolution of NaNO_3 from caliche and the principles of counter-current leaching. *Ibid* 254.—Calcs. of the washing efficiency and necessary evapn. for high nitrate extns. from caliche. *Ibid* 300.—Calcs. of max. densities and nitrate concns. in solns. produced in leaching caliches. *Ibid* 351.—Study of atmospheric evapn. of nitrate liquors. The conclusion is reached that it is technically feasible to obtain high nitrate extns. from caliche with no more excess water than corresponds to the natural evapn. from the system. J. B. HOBBSAWN. *Ibid* 2, 400(1920); 2, 446(1921).—Comments and calculations referring to the above article in which opposite conclusions are reached. E. ALMEYDA ARROYO.

Ibid 491.—Working up mother liquors. Calcs. on evapn. *Ibid* 530.—Notes on boiling the solutions in the leaching tanks. Practical observations of the author.

C. L. BURDICK

Nitrate deposits of the Sahara. ANON. *Caliche* 2, 206(1920).—Examination of reported nitrate deposits in the Sahara Desert show them to be of no commercial significance. The nitrate (a mixture of NaNO_3 and KNO_3 with other soluble salts) occurs as an efflorescence on certain ledges and outcrops. The production of nitrate from this source does not exceed 60 tons per year.

C. L. BURDICK

Lowering the borax content of crude potassium nitrate. R. ROCHNA. *Caliche* 2, 45(1920).—The means suggested for avoiding the contamination by borax of the crude KNO_3 obtained as a by-product in nitrate manuf. are: (1) Lowering the degree of concn. of the soln. to be crystallized. (2) Pptn. of the H_3BO_3 by CaO before crystn. (3) Recovery of the potash by refrigeration below 0° instead of by evapn.

C. L. BURDICK

A study of the commercial possibility of manufacturing copper sulfate in the Argentine Republic from chalcopirite containing 10% of copper. ENRIQUE V. ZAPPI. *Anales soc. quim. Argentina* 7, 433-9(1919).—A detailed estimate of the costs of the various steps of the process. The process is not described.

L. E. GILSON

The preparation of cyanogen bromide and iodide. V. GRIGNARD AND P. CROUZIER. *Bull. soc. chim.* 29, 214-17(1921).—When CNI or CNBr is prepd. commercially by a reaction of the type $\text{Br}_2 + \text{NaCN} = \text{NaBr} + \text{CNBr}$, $\frac{1}{2}$ of the Br used must be recovered from the NaBr . Likewise, if the reaction $2\text{NaBr} + \text{NaBrO}_3 + 3\text{NaCN} + 3\text{H}_2\text{SO}_4 = 3\text{CNBr} + 3\text{Na}_2\text{SO}_4 + 3\text{H}_2\text{O}$ is used the Br must be recovered from the NaBr formed in the manufacture of NaBrO_3 . In obviating the necessity of this Br recovery the authors have made use of the fact that Cl_2 displaces Br_2 and I_2 immediately from NaBr and NaI , but does not attack CNBr or CNI ; and that Cl_2 reacts only very slowly with NaCN to form CNCl . The first stage in their method of prepn. of CNI is the adding of a soln. of NaCN to I_2 suspended in H_2O until the soln. is decolorized. Cl_2 is passed into the resulting mixt. of $(\text{CNBr} + \text{NaBr})$, and then NaCN soln. is added gradually, with always a slight excess of I_2 in the soln. to avoid the reaction $n(\text{NaCN} + \text{CNI}) = n\text{NI} + (\text{C}_2\text{N}_2)_n$. Finally an excess of NaCN soln. is added just sufficient to decolorize the soln., and the CNI is extd. with ether. The yield was 88.9% with respect to the I_2 used. When this method is applied to the prepn. of CNBr the soln. should be cooled during the reaction. In the first stage crystals were pptd. which were possibly a double compd. of NaBr and CNBr ; but when Cl_2 was passed into the soln. they changed to needles of CNBr . The CNBr may be sepd. by distg. the reaction mixts., which shows that the velocity of hydrolysis of CNBr is small at the distn. temp. Or, the CNBr crystals may be sepd. by filtration, in which case the mother liquor contains a small amt. (4%) of CNBr , which can be recovered by distg. and passing the vapor through a CaCl_2 tube heated to 80° . The yield of CNBr was 91%. During these preps. slight brown discolorations or deposits due to azulmic products may appear. Industrially this method would permit the using of impure NaBr or NaI contaminated with chlorides or other salts, and the reaction could be limited to the second stage. The reaction $\text{NaClO}_3 + 3\text{NaBr} + 3\text{NaCN} + 6\text{H}_2\text{SO}_4 = 6\text{NaHSO}_4 + \text{NaCl} + 3\text{CNBr} + 3\text{H}_2\text{O}$ gave a yield of only 75%; this probably could be improved.

R. S. LOMBARD

Processes of hydrogen production for aeronautics in Germany. GINO GALLO. *Giorn. chim. ind. applicata* 3, 106-10(1921).—Descriptive. Sketches of app. are given.

ROBERT L. POSMONTIER

A new type of thickener (ANON.) 1. Ammonia-carbonic acid compounds in equilib-

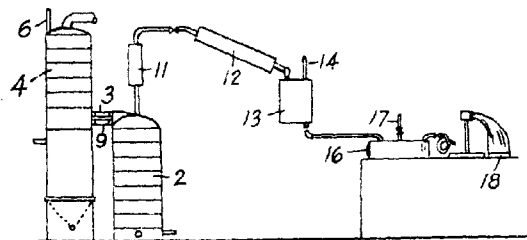
rium with their aqueous solutions (TERRES, WEISER) 2. Alcohol and potassium compounds from molasses (U. S. pat. 1,376,662) 16.

GRANIER, MILE.: *La cyanamide calcique*. Paris: Gauthier-Villars et Cie. 114 pp. F 7. For review see *Rev. prod. chim.* 24, 368(1921).

Apparatus for crushing caustic alkali. J. R. GILDA. U. S. 1,375,503, Apr. 19.

Lead oxide made from basic carbonate. H. S. REED and H. L. PUBLOW. U. S. 1,376,581, May 3. Basic Pb carbonates containing org. matter, such as are left from treating molasses with Pb compds., are dried and granulated, introduced into a revolving drum in a vented elec. furnace and agitated and slowly heated with air to about 315° to oxidize the org. matter until a test portion heated to above the dissociation point of the basic Pb carbonate shows no reduction to metallic Pb. The charge is then introduced into a closed elec. furnace provided with a vent for the CO₂ formed and having a revolving drum for heating and agitating the material and is heated to about 600–650° in the atm. of evolved CO₂ to produce granular PbO.

Ammonium sulfate. KOPPERS CO. Brit. 156,170, Dec. 31, 1920. (NH₄)₂SO₄ crystals are neutralized by means of NH₃ withdrawn from the "fixed" section of an NH₃ still. The crude ammoniacal liquor entering the "free" still 4 by pipe 6 reaches the tank at the bottom contg. milk of lime and passes through pipe 9 to a "fixed" still 2. Part of the NH₃ liberated therein passes into 4 but the remainder is used as described below for neutralizing the acid crystals of (NH₄)₂SO₄ in the centrifugal drier 18. This NH₃ is substantially pure, the S compds., cyanides and phenol having been fixed by the



lime. The concn. of the NH₃ leaving the "fixed" still is regulated by means of the condensers 11, 12, to remove H₂O, and the mixing tank 13 having the water-supply 14 to add H₂O, when necessary. The temp. of the NH₃ is adjusted in the blowing tank 14 to add H₂O, when necessary. The temp. of the NH₃ is adjusted in the blowing tank 14 to add H₂O, when necessary. The temp. of the NH₃ is adjusted in the blowing tank 14 to add H₂O, when necessary. When considerable quantities of NH₃ are required, a valve is inserted in the pipe 3 to control the amt. passing to the "free" still. Preferably the liquor used contains from 1–3 g. of NH₃ per l. and is kept at a temp. of 80–90°, but the spraying may also be performed in the cold.

Alkali silicates. F. J. PHILIPS and E. J. ROSE. Brit. 151,339, June 19, 1919. In order to obtain a sol. alkali silicate of high silica content, the product obtained by the fusion of alkali and silica is dissolved in H₂O and an acid then added, whereby gelatinous silicic acid is thrown down, and this ppt. by continued agitation is made to re-dissolve in the soln. The acid, preferably H₂SO₄, may be added in the form of spray; and after the subsequent operation of agitation or grinding, the soln. may be evapd. to dryness. Moreover, to increase the fusibility of the alkali and silica, a little borax may be employed in the fusion process.

Process for the extraction of sodium nitrate. HARRISON S. COX. Chilean, 2699. The finely crushed nitrate ore is leached at 70° with weak mother liquor and the pulp freed from solution values by filtration. The soln. is divided into 2 parts, one of which is cooled to deposit impure crystals and yields mother liquor. These impure crystals are dissolved in the other part of the soln. at a boiling temperature and the residue separated from the hot concd. soln. This soln. on cooling gives pure commercial NaNO_3 and mother liquor to return to the process. A flow sheet is given.

Alkali metal aluminates. P. MIGUET. U. S. 1,376,563, May 3. Clay or a similar ore of Al_2O_3 is reacted upon with CaO or CaCO_3 or a similar alk. earth compd. which upon heating alone leaves an oxide, together with a reducing agent such as C or carbide of Al, Ca, or S at a temp. (usually in an elec. furnace) sufficiently high to reduce substantially all oxides present in the ore except Al_2O_3 , the reduced material is sepd. from the alk. earth aluminate by stratification and the aluminate is reacted upon by alkali metal carbonate, to form alkali metal aluminate.

Aluminium chloride. M. SHOELD. U. S. 1,375,116, Apr. 19. AlCl_3 is produced by heating Al_2O_3 to 1600–2000° to render it completely anhydrous and then treating it with Cl in the presence of C, which forms CO by exothermic reaction with the O of the Al_2O_3 .

Alkali metal sulfide. W. H. LANDERS. U. S. 1,374,209, Apr. 12. Alkali metal sulfide such as Na_2S is made by mixing and effecting reaction between an alkali metal salt of a strong inorg. acid such as NaCl and carboniferous sludge acid such as is obtained in refining petroleum oils, which usually contains at least 5% of homogeneously distributed C, and then subjecting the carboniferous sulfate produced to a sufficiently high temp. to reduce the sulfate to sulfide.

Basic zirconium sulfate. E. J. PUGH. U. S. 1,376,161, Apr. 26. Cl is passed over heated Zr ore to sublime the Zr content from the ore, H_2O is added to the sublimate to dissolve its Zr content and H_2SO_4 is added to the soln. to ppt. basic Zr sulfate.

Carbides and their derivatives. F. E. NORTON. U. S. 1,374,317, Apr. 12. A carbide-forming charge which may contain oxide, hydroxide, carbonate or silicate of Ca or Al together with an excess of C (coal or coke) is fed down through a shaft furnace supplied with O to support combustion. Carbide collects in molten form in the lower part of the furnace and may be immediately converted into cyanamide by treatment with N.

Purifying hydrogen. E. K. RIDEAL and H. S. TAYLOR. U. S. 1,375,932, Apr. 26. CO is removed from H by adding steam to the mixed gases, passing the mixt. into contact with a catalyst such as oxides of Fe, Cr, Ce or Th, which is preferably employed at a temp. of about 400–500°, in order to convert a large portion of the CO into CO_2 , then adding air or O and passing the gases into contact with oxides of Fe, Cu and Mn or Ce or other catalyst at a temp., preferably about 120–250°, at which O will combine with CO in preference to H. The CO_2 may be sepd. from the H by any suitable method.

Treating mined sulfur. R. F. BACON and H. S. DAVIS. U. S. 1,374,897, Apr. 19. The free burning quality of mined S containing oil is improved by carbonizing the oil by maintaining a molten body of the S containing it at a temp. of 400–430° for a requisite time. U. S. 1,374,898 relates to a similar process in which, after the carbonization of the oil, the S is somewhat cooled but maintained above its m. p. for a sufficient time to permit the segregation of the C formed from the oil.

Obtaining sulfur from sulfur ores. G. A. BRAGO. U. S. 1,374,422, Apr. 12. A pulp of S ore mixed with gang is heated to the m. p. of S and the mass is agitated to promote coalescence of particles of S into aggregates larger than the particles of gang, and these aggregates are then solidified and sepd. from the gang.

Oxidizing carbon monoxide. J. C. CLANCY. U. S. 1,376,514, May 3. Mixts.

containing CO together with H and CO₂, *e. g.*, water gas for making NH₃, are subjected to a selective combustion of the CO by the action of O or air in the presence of a catalyst formed of expanded CuCN₂ at a temp. of about 300°. TiO₂, Pb chromate and V chromate also may be used as catalysts.

Nickel catalyzer. S. DRUCKER and W. SIECK, JR. U. S. 1,375,368, Apr. 19. A Ni catalyst is prepd. by washing pptd. NiCO₃ to remove all sol. salts, adding a powdered inert non-reducible material such as mica, talc, asbestos, graphite or kieselguhr and, after drying the mixt. without calcining, reducing it with H.

Phenolic condensation product. L. V. REDMAN, A. J. WEITH and F. P. BROCK. U. S. 1,374,526, Apr. 12. A phenolic condensation product is formed without the use of a condensing agent by boiling together equal amts. of a 40% CH₂O soln. and PhOH until there is formed a viscous gummy lower layer and an aq. upper layer containing about 10% CH₂O. The aq. layer is discarded and the mass is shaped and hardened by heating for a long time at a temp. of about 50–100° until the material becomes hard, insol. and anhydrous, and then heating to a temp. of about 125° for several days to improve the color and other qualities of the material.

Filling porous materials with liquids. C. W. DAVIS and W. S. BROWN. U. S. 1,374,362, Apr. 12. Porous material such as paper cable wrapping is immersed in an oil compn. or other liquid with which it is to be impregnated and as absorption proceeds the bath is subjected to repeated sudden drops in pressure to remove entrained gas bubbles.

Waterproofing porous materials. W. V. LANDER. U. S. 1,376,553, May 3. A porous material such as *leather* or *paper* is impregnated with a non-paraffinic compn., which may be formed of crude petrolatum and resin, in order to waterproof it.

Adhesive cement. T. EDWARDS. U. S. 1,374,992, Apr. 19. A cement adapted for use on leather or other materials is formed of rubber 10 lbs., dextrin 10 lbs., a solvent for rubber such as naphtha 14 gals., H₂O (as a solvent for the dextrin) 1.5 gals. and glucose 2.5 lbs.

Fusible adhesive for use with gold leaf. F. H. DAVIS. U. S. 1,374,492, Apr. 12. Shellac is boiled with a soln. of NaCl and NH₄OH to form a ppt. which is free from greasy or fatty substances and is of a fusible character suitable for transferring Au leaf from its backing to the surface to which it is to be attached without discoloration of the leaf.

Fire-extinguishing composition. P. A. CROSBY, R. R. MATTHEWS and R. B. HIGH. U. S. 1,375,779, Apr. 26. A compn. is used such as may be formed of NaHCO₃ 8, a phosphoprotein such as casein 2 and H₂O 90 parts. The mixt. is used together with an Al₂(SO₄)₃ soln. to form a foam.

19—GLASS, CLAY PRODUCTS, REFRACTORIES AND ENAMELED METALS

G. H. BARTON, C. H. KERR

Electric load conditions in the glass industry. C. W. FICK. *Gen. Elec. Rev.* 24, 539–42(1921); illus.—Includes a brief account of modern plate-glass manuf. C. G. F.

The design and operation of glass-house furnaces. F. J. DENK. *J. Am. Ceram. Soc.* 4, 224–236(1921).—Proper design of regenerators is discussed; it is taken into account that gases being cooled should move downwards, and gases being heated upwards. The location of ports, insulation, and operation of reversing valves are important. Combustion should be controlled by draft recorders, thermocouples, and analysis of the products of combustion.
J. S. LAIRD

A simple expansibility test for determining the welding properties of glasses. D. E. SHAW. *J. Am. Ceram. Soc.* 4, 219-23(1921).—Rods of the glasses are heated side by side, welded by pinching, and drawn out into a thread. On cooling the compd. thread bends toward the glass having the higher coeff. of expansion. This may be used as a welding test, as only glasses which do not bend or bend only slightly can be readily fused together, or to det. coeffs. by comparison with standard glasses. J. S. LAIRD

The etching of flashed glasses. ERNST BEUTH. *Glas-Industrie* 30, 109-10 (1919). J. B. PATCH

"Keramo." F. Z. *Glasind.* 30, 197-8(1919).—Descriptive of the French Garchey process for the manuf. of decorative building stones from glass. J. B. PATCH

Is there need for improved glass in preserve jars? H. THIENE. *Glas-Industrie* 30, 101-3(1919).—T. demonstrates the need for better glass to withstand temp. changes and soly. Jena glass is recommended. J. B. PATCH

The new factory of the Monongah Glass Company. E. W. TILLOTSON. *J. Am. Ceram. Soc.* 4, 3-24(1921).—This factory is of modern, permanent construction, and is equipped for continuous, mechanical production of packers' glasses. It is provided with continuous furnaces, mechanical feeders, presses and leers which are described in detail with illustrations. J. S. LAIRD

Machine-drawing of glass tubing. J. F. SPRINGER. *Glass Industry* 2, 110-12, 138-40(1921); illus.—A detailed description of the Edward Danner tube-drawing machine as operated by the Kimble Glass Co. of Vineland, N. J. J. B. PATCH

Processes in the manufacture of lenses. DONALD E. SHARP. *Glass Industry* 2, 133-7(1921); illus.—The scientists of the Geophysical Laboratory have reduced considerably the annealing time for glass for lenses by holding the glass for a definite time at a temp. lower than the annealing temp. and then cooling with comparative speed and at an increasing rate as time goes on. America leads the world in the manuf. of optical glass, lenses and optical instruments. J. B. PATCH

Novel method of handling molten glass. ANON. *Glass Industry* 2, 142(1921).—Molten glass can be drained from tanks through a 1" hole on to a 40' steel pan conveyor on which water is sprayed. This delivers the glass to another belt conveyor similarly equipped with water on which a canvas belt impregnated with rubber has been used successfully. Saving of time and labor is effected and the glass is very conveniently broken up. J. B. PATCH

The mutual relations between art and technology. L. V. SOLON. *J. Am. Ceram. Soc.* 4, 263-70(1921).—An analysis of decoration and of the characteristics of bodies, colors and glazes which det. their acceptability for the purposes of the professional decorative artist. J. S. LAIRD

Note of the effect of time on the drying shrinkage of clays. R. F. GELLER. *J. Am. Ceram. Soc.* 4, 282-7(1921).—Conclusions: drying time depends largely on H₂O content; the structure of the clay is an important factor; the total shrinkage is proportional to the H₂O content, and is not influenced by the rapidity of drying. J. S. LAIRD

The layout of a brick or tile plant with a car tunnel kiln. T. W. GARVE. *J. Am. Ceram. Soc.* 4, 277-81(1921).—A detailed description and diagram of a hollow tile plant using a tunnel kiln. J. S. LAIRD

An electric vitreous enameling oven. C. W. MEHLING AND J. W. CARPENTER. *J. Am. Ceram. Soc.* 4, 271-6(1921).—This furnace is constructed with *nichrome* resistors and operates at 1700° F., producing 900 lbs. of ware per hr. The initial cost is high but the fuel cost is no greater than with gas-fired furnaces. The ware has a better finish. J. S. LAIRD

Properties and preparation of ceramic insulators for spark plugs. I. Methods of measuring resistance of insulators at high temperatures. F. B. SILSBEE AND R. K.

HONAMAN. Nat. Advisory Comm. Aeronautics, *Fifth Annual Rept.* 1919, 77–89 (1921).

—Measurements were made at 200–900° with both a. c. and d. c. at voltages up to 2000. Resistance decreased rapidly with increase in temp. in porcelain, mica, fused SiO_2 , and similar materials but there are no sudden changes. A convenient comparison figure is the temp. (T_s) at which the resistivity is 1 megohm per cc. This temp. for various substances is: fused SiO_2 , 890°; best porcelain tested, 790°; typical mica plug, 720°; av. of 3 aviation porcelains, 650°; av. automobile porcelains, 490°. In the measurements with d. c., polarization effects disturbed the readings. The mechanism of conduction in this class of materials is exceedingly complex and merits wide investigation. II. Electrical resistance of various insulating materials at high temperatures.

R. K. HONAMAN AND E. L. FONSECA. *Ibid* 91–9.—To obtain reliable findings, tests were made at 550 v., 60 cycle, a. c. Polarization was thus avoided. Cond. increased about 2% per degree. The temp. (T_s), at which resistivity was 1 megohm per cc., varied from 870° for fused quartz to 280° for some kinds of glass. Many findings are recorded. Porcelains developed at the Bureau of Standards showed as high as 800°. Most spark-plug porcelains show about 500°. Any material with T_s less than 400° should be used only when the design of the plug is such that the insulator is very well cooled. III. Preparation and composition of ceramic bodies for spark-plug insulators.

A. V. BLUMINGER. *Ibid* 101–7.—Spark plugs in airplane engines are subjected to high temps., sudden heating and cooling and mechanical stresses. A suitable material, therefore, must remain a good insulator at the max. temp. reached, not be subject to permanent vol. changes, possess const. thermal expansion and be strong and tough. The best types developed at the Bureau of Standards are given. No. 152 contained: Georgia kaolin, 10; Florida kaolin, 10; N. Car. kaolin, 10; Del. kaolin, 10; Calcine No. 19, 40; Calcine No. 14, 20%. Calcine No. 19 contained: Kaolin, 70.2; Al_2O_3 , 27.8; B_2O_3 , 2.0%. Calcine No. 14 contained: Kaolin, 56.0; MgCO_3 (pptd.), 18.2; potter's flint, 25.8%. Another excellent porcelain was No. 194 containing: Beryl, 35.0; Georgia kaolin, 12.5; Florida kaolin, 12.5; N. Car. kaolin, 12.5; Del. kaolin, 12.5; potter's flint, 15.0%.

C. H. KERR

The new Meurer enamel spraying process. ANON. *Glashütte* 51, 131–2, 147–8 (1921), 1 fig.—A modification of the Schoop spraying gun or nozzle. J. B. PATCH

Refractories for electric furnace (HOWE) 4. A mercury volumeter (GOODNER) 1.

Articles of quartz glass. J. SCHARL. U. S. 1,375,657, Apr. 19; cf. C. A. 15, 1200. Quartz is heated to form a plastic mass in an elec. resistance furnace about a resistance core, the bottom of the fused mass is closed and it is then removed from the furnace and blown to the desired shape.

Applying coloring material to sheet glass. M. J. HOWARD. U. S. 1,375,251, Apr. 19. Coloring material, such as mottled colors and Batavia gum, is placed on the surface of H_2O or other suitable liquid, articles of sheet glass or similar materials are dipped into the liquid to cause the coloring matter to adhere to their surface, the articles with attached coloring matter are removed from the liquid, coated with paint and then freed from adhering liquid.

Graphite crucibles. J. H. L. DEBAYS. U. S. 1,374,909, Apr. 19. In the manuf. of crucibles from graphite and clay, 1–10% of a non-ferrous metal such as Cu, Ni, Cr or Co is mixed with the material for the formation of the crucible so that when the latter is used a metallic silicate coating forms upon its surface which gives durability to the crucible. U. S. 1,374,910 relates to the addition of Mg, Al or ferro-Al 1–10% to material such as clay and graphite from which crucibles are made so that the latter may be burned shortly after molding and the cost of slow drying thus eliminated.

Refractory composition. H. H. BUCKMAN and G. A. PRITCHARD. U. S. 1,375,077, Apr. 19. In the prepn. of refractory articles such as furnace linings, muffles or the like, zircon is used with a clay binder.

Refractory material. M. L. HARTMANN. U. S. 1,376,091, Apr. 26. A refractory material is formed of carborundum with Zr silicate and Al silicate as bonding materials.

Refractory heat-insulating material. P. G. WILLETTS. U. S. 1,374,538, Apr. 12. A refractory material adapted for boiler settings or the like is formed by burning a mixt. of finely divided lignite coal and plastic fire-clay having a high silica content.

20—CEMENT AND OTHER BUILDING MATERIALS

C. N. WILEY

Special ferri-ferrous agglomerate and its applications in presence of pozzuolanous substances. FABIO FERRARI. *Giorn. chim. ind. applicata* 3, 53-6(1921).—The ferri-ferrous agglomerate had the following compn.: $\text{SiO}_2 = 24.04\%$, insol. siliceous residue = 0.23, $\text{Al}_2\text{O}_3 = 3.32$, $\text{Fe}_2\text{O}_3 = 5.24$, $\text{CaO} = 65.10$, $\text{MgO} = 0.47$, $\text{SO}_3 = 0.61$, alkali (not detd.) = 0.94. F. drew the following conclusions from this study: (1) Cements of this type, in which the sesquioxides stand in equiv. relations, are free from binary combinations of these sesquioxides. They are, therefore, stable towards the action of sulfates and chlorides. Since the greatest fusibility of the material forming the second consolidation of the clinkers corresponds to the existence of the above mentioned equiv. proportions, the above type of cements may be regarded as products showing the easiest scorification and containing the greatest amounts of hydraulics (Ca silicates). They may, therefore, be substituted in all applications, not only of ferroportlands, but also of ordinary portlands. (2) Pozzuolanous substances added to the above type of cements moderate their high basicity and fit them for mortars of the highest permeability. These mixts. also possess a mechanical resistance greater than mortars of ordinary portlands in general use.

ROBERT S. POSMONTIER

Electrified cement industry. LLOYD W. CHAPMAN. *J. Elec. Western Ind.* 47, 7-9(1921).—The method of mfg. portland cement at the Santa Cruz Portland Cement Co. is briefly described with 5 illustrations. About 60% of the K_2O that enters the plant is recovered. The product contains about 33% K_2O , is completely sol. in water and is very suitable for fertilizers, being free from any injurious impurities. The K is recovered from the dust by a Cottrell precipitator.

C. G. F.

Law governing the hardening of cement. J. BIRD and E. GARNIER. *Rev. ing. index tech.* 28, 269-72(1921).—The tensile strength of cement after 84 days can be calcd. from the strengths at 7 and 28 days from the formula $R_{84} = K(2R_{28} - R_7)$ where K is a const. which is very near 1 for all except quick-setting cements. Hence the hardening equation is hyperbolic and is $(t-3.6)(h-2.7) = 152$ for cements and $(t-8.5)(h-8.7) = 429$ for limes, where t is the time (the meaning of h is not given). Calcd. and detd. values are given for 2 samples and show very close agreement.

A. P.-C.

The relation between the fineness and other properties of calcined gypsum. W. E. EMLEY and F. C. WELCH. *J. Am. Ceram. Soc.* 4, 301-5(1921).—Finer grinding of calcined gypsum increases the amt. of H_2O needed for normal consistency, shortens the setting time, increases the strength up to size 6 (A.S.T.M. specifications), and increases its sand-carrying capacity.

J. S. LAIRD

Curing cement. G. L. SMITH. U. S. 1,374,403, Apr. 12. Articles of cement, cement mortar or concrete are cured by heating while maintaining them under sufficient air or gas pressure to counteract the steam pressure developed within the material.

Cement mixture for making artificial stone. G. M. FORMBY. U. S. 1,376,523, May 3. A plastic compn. adapted for making polished artificial stone is formed by adding H₂O and lime to Ca oxychloride, boiling this mixt. and permitting it to set and then mixing Keen's cement with it.

Composition for artificial stone or brick. W. L. SANDERSON. U. S. 1,376,464, May 3. A mixt. for forming brick or artificial stone is formed of sand 5 cu. ft., red oxide of Fe 3.75 lbs., plaster of Paris 2.5 lbs., ocher 1.25 lbs., sugar 10 oz. and cement 95 lbs., mixed with H₂O 7.5 gals.

Coloring concrete and stucco. J. J. EARLEY. U. S. 1,376,748, May 3. Predetd. color effects in concrete or the like are obtained by grading aggregate to definite size and color, mixing it with cementing material such as portland cement and H₂O and then molding the mixt. and treating its surface so that the aggregate protrudes from the surface.

"Non-slipping" paving material. P. F. SOLAN and H. S. BALLIET. U. S. reissue 15,097, Apr. 26. See original pat. No. 1,193,938, C. A. 10, 2516.

Composite wall-board. H. S. LEWIS. U. S. 1,374,931, Apr. 19. A laminated wall-board is formed with center plies containing wood pulp made from ground, cooked hard wood and outer plies including pulp made from other material such as soft wood pulp.

Impregnating fabric with tar and cement. C. S. HATHAWAY. U. S. 1,374,885, Apr. 12. A material adapted for use as a fire-resisting roofing is prep'd. by impregnating burlap or a similar fabric with a mixt. formed of water-gas tar 3 gals., hydraulic cement 1/2 bbl., asbestos fiber 30 lbs., Mn resinate 15 lbs., menhaden oil 1 gal. and naphtha 4 gals.

Roofing felt. A. L. CLAPP. U. S. 1,374,187, Apr. 12. A flexible sheet is formed of a mixt. of rag fiber and sawdust of good penetrability and strength for use as a foundation for prep'd. roofing which may be sat'd. with tar, pitch and asphalt. Cf. C. A. 15, 742.

Roofing material. O. A. HEPPES. U. S. 1,376,092, Apr. 26. A material adapted for use as a roofing is formed by coating roofing felt with asphalt or similar adhesive material, applying an overlying layer of crushed colored stone covering the entire surface and partially embedded in the adhesive, and then applying material of a different color to produce a desired design.

21—FUELS, GAS, TAR AND COKE

A. C. FIELDNER

Fuel problems of the future. GRO. BRILBY. *Gas J.* 154, 737-743(1921); *Iron and Coal Trades Rev.* 103, 1-2(1921); *Engineering* 112, 26-30(1921); *Gas World* 75, 6-10(1921); *Engineer* 132, 20-22(1921).—Lecture. B. discusses lignite, oil fuel, alcohol, peat, coal, and smokeless fuel from low-temp. carbonization, as sources of industrial fuel and concludes that coal, after all, is likely to remain for a long time the world's chief source of fuel. The problem is to devise more efficient ways of utilizing it.

J. L. WILBY

Adaptability in coke oven practice. C. R. MEISSNER. *Gas Age* 47, 503-6(1921).—A description of the Koppers by-product triangular-flued ovens at the Jones and Laughlin Steel Co.'s plant near Pittsburgh. Among the special features of the plant are reinforced-concrete casings for the exhausters and boosters, and the flushing of the collecting and suction mains with a mixt. of 40% tar and 60% liquor for maintaining clean mains and for cooling the gas.

J. L. WILBY

Methods for the identification and valuation of coals. F. S. SINNATT. *J. Soc. Dyers Colourists* 37, 108-13(1921).—In addition to the usual chemical and calorific values of a steam coal, it is desirable to know whether physical properties would influence economic combustion as (1) caking or agglutinating power in carbonization; (2) friability in storage and handling; (3) av.-sized lumps—microscopic examn. of thin sections.

A. K. JOHNSON

A simplified method of coal examination. M. DOLCH. *Mitt. Inst. Kohlenvergasung* 3, 1-6(1921).—The dried coal is heated in a transparent quartz tube, inserted in an elec. furnace wound with nichrome wire, and lagged with kieselguhr, this being retained in place by asbestos cord, painted over with Na silicate. The detns. of coke, moisture, ash, tar yield, and quality and quantity of gas are all made in one app. To avoid partial combustion the carbonization is carried out in an atm. of N or CO₂. The passage of a current of dry air over the tar in a special app. greatly accelerates the drying of the tar. The production of tar fog is avoided by slow heating and the use of dried coal. Moisture is estd. by attaching a tube contg. CaCl₂ satd. with CO₂ and weighing before and after a period of 1 hr. during which time the temp. is maintained at 105° and a current of CO₂ is passed through the tube. Coke is estd. by carbonization at 800° for 1½ hr., the carbonization tube being weighed before and after the expt. The wt. of tar plus gas liquor can be obtained from the wt. of the tar tube, and by subsequent drying the percentages of water of constitution and anhydrous tar are obtained. J. S. C. I.

Oxidation of coal and other solid fuels under pressure. F. FISCHER AND H. SCHRADER. *Ges. Abhandl. Kennt. Kohle* 4, 342-9(1919).—The percentages of fuel converted into oxidation products by a pressure oxidation for 3 hrs. at 200° in presence of Na₂CO₃ soln. reached, for older coals 10%, for younger coals above 30%, for lignite and peat above 90%, for wood 75%, and for cellulose almost 100%. Only a moderate proportion was converted into CO₂. Humic acids, clear oily acids, higher and lower fatty acids, and oxalic acid were obtained. The oily acids contained aromatic compds., for when distd. some phthalic anhydride was obtained. No mellitic acid was obtained. Insol. humic acids of high mol. wt., which form the first stage of oxidation of a portion of coal and wood substance and also are present in lignites and peat, are transformed first into more sol. though still dark-colored humic acids and then into lighter-colored acids of progressively smaller mol. wt. Wood such as box and fir yielded humic acids, but pure cellulose none. J. S. C. I.

Recent developments in coal-cleaning processes. ROBERT NELSON. *Gas World* 75, No. 1928 (Coking and By-products Sec.), 14-15(1921); *Engineering* 112, 76-77(1921).—N. describes in a general way the system of flotation of coal (cf. C. A. 15, 1065) for cleaning of fines, and the Belgian Rheolaveur process for cleaning of nut coals. By this process the coal is carried by a strong and steady flow of water through a series of troughs. The rate of flow and the length of trough are so regulated as to allow time for the coal and dirt to stratify, the dirt being drawn off from the bottom of the trough at intervals, and the coal being recovered clean at the end of the trough. The initial maintenance and operation costs are low and its operation is easy. Also in *Electrician* 87, 42-4(1921).

J. L. WILEY

Dry cleaning of coal by means of tables. EDW. O'TOOLE. *Iron Coal Trades Rev.* 102, 819(1921). A paper read before the Am. Iron and Steel Inst.—The machine is similar to those used for sepg. ore by dry-concg. and jigging. Air is used as the floating medium. A blower fan compresses the air within an air chest covered over by a vibrating deck of steel, cloth or silk. The air under pressure is forced through apertures in the deck in tiny jets which on expanding form an air film on the upper surface of the deck. The coal, properly sized, on passing over the deck is stratified, the heaviest particles sinking to the bottom, the lightest rising to the top. The propulsion of the

material across the tables causes these zones to separate and to pass off the table at different points. Coals of all kind are rapidly cleaned, particularly the fine sizes of purer coal. It is estd. that machines working on coal 1.5 to 2 in. in size will clean 10 tons per hr.

J. L. WILEY

Carbozite. H. R. TRENKLER. *Feuerungstechnik* 9, 93-95(1921); *J. Soc. Chem. Ind.* 40, 250A.—Carbozite is produced from lignite, wood or peat by heating the raw material to a temp. not exceeding 450°. By this means all the original H_2O , together with a large amt. of CO_2 , is evolved, thus concg. the combustible matter in less mass. The material is dried to a H_2O content of 10-15% by means of a mixt. of air and waste gases at 75° in drying bunkers arranged over the ovens. Dry coal is sifted; the fines are gasified in producers and the large coal is passed into an annular chamber, the lower part of which forms a cooler. Heat is applied by passing hot gases through the charge at a temp. of 250-300°. Any tar produced is drained off below and allowed to mix with the carbozite. From a coal of compn. C 27.37%, H 2.0%, O and N 10.78%, S 0.54%, ash 3.23%, H_2O 56.08% and calorific value 2110 cal. per g., there was produced a fuel containing C 69.31%, H 4.12%, O and N 13.90%, S 0.91%, ash 5.32%, H_2O 6.44% and calorific value 6290 cal. per g. The great drawback to the process is the fines that cannot be utilized.

C. J. WEST

Calculation of the air factor during combustion. A. B. HELBIG. *Feuerungstechnik* 9, 53-8(1921).—A method is worked out for the calcn. of the air requirements of liquid and gaseous fuels from an analysis of the flue gases with the aid of a triangular diagram.

C. J. WEST

Wood carbonization at Steyning. E. J. FOTYRELL. *Gas. J.* 154, 743(1921).—In order to supplement the supply of coal gas, 8 retorts are charged with oak wood cut in 4-ft. lengths. Five charges per 24 hr. can be carbonized. The yields per cord of wood are: gas 6000 cu. ft., charcoal 4 cwt., tar 13 gal. and a quantity of liquor. No difference is found in the lighting value of the gas from that of coal gas. The liquor has a sp. gr. of 1.02 and contains 1.2 oz. free NH_3 and 3.2 oz. fixed NH_3 . There are present small amts. of $AcOH$ (as $AcONH_4$) and acetone and $MeOH$. The only constituent of value is the NH_3 . The tar is a mixt. of coal-gas tar and wood tar. The tar acids contain practically no phenol, but consist mainly of cresylic acid, guaiacol, and other high-boiling acids found in wood tar.

J. L. WILEY

Fuel research station at East Greenwich. ANON. *Gas World* 75, 3-4(1921); *Gas J.* 155, 24-6(1921).—Report of inspection by gas engineers. (Cf. *C. A.* 14, 2251.) Low-temp. carbonization and briquetting are carried out simultaneously in a specially designed plant by placing the coal into molds inside of the retort. The semi-coke briquets are tough and homogeneous, and withstand considerable rough handling. They contain 10% volatile matter. The tar produced is used for Diesel engine fuel.

J. L. WILEY

Chemistry of combustion. E. V. EVANS. *Gas J.* 155, 30-1(1921); *Engineering* 112, 65-6(1921).—E. shows the nature of the chemical and physical reactions which take place during combustion of raw coal, and the difficulty of controlling its combustion in an adequate manner, and at the same time obtaining the max. conversion of energy. He deprecates the use of raw coal, both from this loss of energy involved and the waste of the chemical products.

J. L. WILEY

Low-temperature carbonization of coal. W. A. BONE. *Gas J.* 155, 31-2(1921); *Engineering* 112, 68(1921).—B. regards low-temp. carbonization as important from the view-point of furnishing a smokeless solid fuel suitable for domestic use at a reasonable price. With the increasing cost of gas production, he feared that gas would become a luxury, especially for heating purposes. In comparing the radiant gross efficiency of the gas-fire with raw coal and with low-temp. semi-coke, he gives to the former an efficiency

of 44%, to the second 24%, and to the third 32%. At costs per therm resp. of 15, 2.5 and 3.0 d., the fuel cost per therm of radiation will be 34, 10.4 and 9.4 d. resp. Such a soln. of the domestic heating problem would bring, besides, a valuable addition to the nation's oil and motor fuel resources, since British coal will yield 10-15% of their wt. in oils and American coals 10-12%.

J. L. WILBY

Standard specification for "benzole" drawn up by the B.E.S.A. ANON. *Automotor J.* 26, p. 131 (1921); *Science Abstracts* 24B, 175.—Because of uncertainty as to what constitutes "benzol" or "benzole" used in reference to the motor spirit sold under that name the Brit. Engineering Standards Assoc. has issued a standard specification. *Definition.*—The term "benzole" shall denote a liquid consisting essentially of a mixt. of benzene, and not more than 30% by vol. of toluene and xylenes. *Description.*—The liquid shall be a clear "waterwhite" liquid, free from undissolved water and other visible impurities. *Specific gravity.*—The sp. gr. at 15.5° shall be not less than 0.870, and not more than 0.885. *Distillation range.*—When 100 cu. cm. of the material are distd. in the standard distn. app. (B.S. Specification, No. 2, D. 15), at a rate of 7 cu. cm. per min. there shall distil at 760 mm. pressure: Not less than 60 cu. cm. at or below 90°, not less than 75 cu. cm. at or below 100°, not less than 90 cu. cm. at or below 120°. The flask shall be dry at a temp. not exceeding 125° (257° F.). The temp. recorded by the thermometer shall be corrected for emergent stem and barometric pressure, by means of the formulas given in the appendix. *Residue.*—The amt. of non-volatile residue remaining, when 20 cu. cm. of the material are evapd., and subsequently heated for 2 hrs. on a water-bath at 100°, shall not exceed 0.01% by wt. *Coloration with sulfuric acid.*—The coloration imparted to pure H₂SO₄ (90% H₂SO₄), free from HNO₃, when 90 cu. cm. of the material are shaken with 10 cu. cm. of the acid for 5 min., at ordinary temps., shall be not more than a light brown. *Sulfur content.*—The total sulfur content shall not exceed 0.4% by wt. A convenient method for the estn. of S is given in the appendix. *Freedom from acid and alkali.*—The material shall give no reaction for free acid or free alkali, when tested by the method described in the appendix. *Freedom from hydrogen sulfide.*—The material shall give no reaction for H₂S when tested by the method described in the appendix. *Freezing point.*—The f. p. shall not be higher than 14° (7° F.) when detd. by the method described in the appendix. The appendices give details of: Method of testing for color; temp. corrections for emergent stem and barometric pressures; methods of testing for S, free acid or free alkali, H₂S, f. p.; and details of the standard distn. apps.

H. G.

The constituents of lignites. R. CIUSA AND A. GALAZZI. Univ. Bologna. *Gazz. chim. ital.* 51, I, 55-60 (1921).—In the transversal fracture of the trunks composing the xyloid lignite deposit of Fognano near Montepulciano, Simonelli observed a white cryst. incrustation (cf. Pictet, C. A. 14, 1424) for literature on such fossil compds.). This compd., C₁₈H₁₆, is readily sol. in C₄H₈, CHCl₃, etc., m. 61-2°, b. 314-6°, b₂ 208-10°. Crystallographic detns. on the natural and artificial crystals are given. By comparison with 7 other compds. obtained from lignite it is shown that the compd. is a new species of mineral and it is named *simonellite* (A). This compd. does not absorb Br, does not decolorize KMnO₄ in AcMe soln. nor in aq. acid soln., but in aq. alk. KMnO₄ or CrO₂ soln. it gives a red compd. which was not purified. In order to sep. some other cryst. compds. a quantity of lignite was treated by a process, not described, which gave a dense brown liquid from which A slowly sepd. Fractions b₂ 145-55°, 155-70°, 170-200° and 200-40°, resp. were sepd. The last fraction sepd. much A, which was filtered off and the liquid part of this and the other fractions were boiled with Na. The fractionation was then repeated at ordinary pressure: (1) 222-8°; (2) 240-4°; (3) 263° and 314-6° (or A). (1) and (2) consisted of C₁₈H₁₆ while that boiling at 263° was C₁₈H₁₄. Further work on larger quantities of material will be required to establish the structures and

relations of these compds. Samples of lignite from Terni showed a hydrocarbon incrustation (B), m. 71-2°; after purification m. 74-5° and had the compn. $C_{30}H_{24}$. The characteristics of this compd. resemble those of hydrodicamphene (C) (Houben, *Ber.* 38, 3800(1905); Etard, Mecker, *Compt. rend.* 126, 526(1875)) but the compds. have not been compared more closely. Moreover bombicite and hartite have the same m. p. although the compn. given in the literature is different. A sample of bombicite from the Museo di Mineralogia m. at 75° and also m. 75° when mixed with B. This shows that probably all 3 are identical and may perhaps be composed of C. A lignite known as *lignite di Forlì* was quite different in appearance from the others and gave a compd. $C_{24}H_{16}O_2$, m. 78-9°, which compn. conforms with that of lignocerinic acid and which gives the characteristic Pb and Ag salts of that acid.

E. J. WITZEMANN

Institution of gas engineers. THOS. GOULDEN. *Gas J.* 154, 536-41(1921).—
Presidential address. J. L. WILEY

Sixth report of the research sub-committee of the gas investigation committee of the institution of gas engineers. A. PARKER. *Gas J.* 154, 619-27, 672-6(1921); *Gas World* 74, 501-3(1921); cf. *C. A.* 14, 2408, 2409.—Report on investigations of the blue water-gas process and comparison with results of steaming obtained at Uddingston last year. Three tests were made, the av. water gas made containing less than 5% CO_2 , more than 39.5% CO , and more than 48% H_2 , the inerts including O less than 9%, the CH_4 ranging from 0.35 to 1.3%, the net calorific value about 275 B. t. u. per cu. ft. The amt. of fuel in therms required for raising steam, calcd. at 70% boiler efficiency, was 57 therms per ton of coke. The av. thermal efficiency of gas production was 46.3% as compared with 54.4% without steaming and 62.1% with steaming at Uddingston. The greatest loss in heat is represented by the potential heat of the blow gas or about 20% of the heat supplied. The av. amt. lost as sensible heat in the water gas, blow gas and undecomposed steam was approx. 8.6% of the heat supplied. These losses might be considerably reduced by installation of waste-heat boilers. The heat per 1000 cu. ft. of water gas made available for use in a waste-heat boiler would raise approx. 69, 74 and 78 lb. of steam, resp., for the 3 tests on a 70% boiler efficiency. This would raise the av. efficiency of water-gas production to 55.9%. Considerable trouble was caused during the process by the deposition of a yellowish brown powder in a finely divided condition in almost all sections of the plant beyond the scrubber. Investigation is being made to det. the cause of it. An analysis of it shows tarry and carbonaceous matter 11.3, free S 7.8, Si 66.9, and oxides of Fe and Al 2.5%. Tests of the water gas made showed that there was little change in the av. compn. of it when normal "up-down-up runs" were made. When the runs were all in an upward direction a larger proportion of CO_2 resulted, indicating a reduction in the temp. of the fuel bed. The percentage calcd. proportions of steam converted into water gas during a complete clinker to clinker period is approx. 70%. The efficiency decreases as each run proceeds to as low as 41%. The H_2S content of the gas made during the normal coking to coking periods was approx. const. at about 230 grains per 100 cu. ft., but during the period of up-runs it increased to as much as 400 grains. Full details of operation and complete data are given.

J. L. WILEY

Conditions affecting the usefulness of iron oxide for city gas purification. WM. A. DUNKLEY. Univ. of Ill. Eng. Expt. Sta., *Bull.* 119, 62(1921); *Gas Age* 48, 11-13(1921); *Chem. Trade J.* 69, 3-4(1921).—Oxides employed in gas-plant practice may be divided into 4 general classes: (1) natural oxides; (2) oxides produced from metallic iron by rusting; (3) oxides pptd. from solns. of Fe salts; (4) oxide resulting from burning pyrites in H_2SO_4 manuf. Good oxides of each type are available, and the real problem is the selection of the material best suited to a particular case. The only way to predict the value of a material is actually to sulfide it on a small scale; the Kumberger

app. for performing the test either with purified H_2S or unpurified town gas is described. *General conclusions.*—The usefulness of iron oxide depends upon its physical, and perhaps its molecular, structure rather than upon its Fe content. The value of a particular oxide may be detd. by the rapidity or activity of it for decomposing H_2S , and by the ultimate capacity for decomposing H_2S under operating conditions. It is doubtful that ferric oxide forms any hydrates other than the mono ($Fe_2O_3 \cdot H_2O$) and that this even exists among the synthetic oxides commonly used in gas purification, although the latter quite often resemble the natural hydrated oxides in physical and chemical properties. Therefore, the water which affects the behavior of oxides as gas-purifying agents is probably water absorbed on the surface of the material. For every oxide there is a best water content for the most efficient action, more or less than this being unfavorable to the activity of the oxide. It varies also with different oxides; the lighter, more porous types retain a high activity over a greater range of water content than do the denser materials. In general, those materials which retain the most water are the most active. Those of a yellow or yellowish brown color are generally more active than the red or reddish brown oxides. The former are generally more porous, of lower density, and of higher water content, and retain their activity over a considerably greater range of water content. They, however, lose this efficiency by being heated to 400° for a few hours, being transformed into the red type. Remoistening will sometimes restore it. Oxides of ferric salts pptd. from concd. solns. by alkali hydroxides or carbonates, and rust oxides made with the use of rusting solns., appear to be comparatively slow in decomposing H_2S . They are still slower in action after heating to 100° . Oxides pptd. from ferric or ferrous sulfate solns. by Ca or Ba hydroxides or carbonates, and oxides resulting from the slow rusting of Fe at a low temp. and in the presence of considerable water resemble the natural oxides, and their activities are usually as great or greater and retain their values over a rather wide range of water content. In general, the more active oxides revivify more quickly and retain their activity over successive foulings with H_2S better than the slower oxides. Improvement in oxides can come only through an understanding of the effects of fundamental conditions upon the character and performance of the product. The effect of alkalis upon their behavior should be further studied, and research should be made toward discovering catalytic agents which would increase the speed of some of the oxides of large capacity. It appears probable, owing to the unavoidable limitations of oxide purification, that the gas industry must eventually abandon oxide purification for some other process which involves less labor and less space for equipment, and which produces S in a form available for industrial purposes. Also in *Gas World* 75, 131-5 (1921); *Gas J.* 155, 382-3, 436-9, 491-3 (1921).

J. L. WILEY

Desiderata in the qualities of town gas. J. S. G. THOMAS. *Gas J.* 154, 735-6, 155, 28-9 (1921); *Gas World* 75, 12-14 (1921); *Engineering* 112, 78-9 (1921).—Two fundamental postulates can be made for the guidance of the gas industry. Town gas should be such that the products of its combustion should be CO_2 and H_2O only, and that, subject to economic considerations; the constitution of coal gas and its method of distribution and utilization should be such as to involve the minimum needless expenditure or degradation of energy. In this connection, S compds. should be eliminated as completely as possible. It also seems desirable that town gas should contain the minimum amt. of inert gases, such as CO_2 and N, and that there should be no legal restriction as to the amt. of inert gases permissible. Naphthalene and CN should be eliminated as completely as possible because of the difficulties imposed by their presence on the distribution and utilization of gas. In regard to the question of placing legal restrictions on the % compn. of the gas as regards combustible constituents, T. calls attention to the fact that the actual compn. can be varied within wide limits without

affecting the calorific value. There is no reason, at present, why any such restriction should be imposed on the industry.

J. L. WILEY

Report on the Simmance total-heat recording calorimeter. T. GRAY AND A. BLACKIE. Fuel Research Board, *Tech. Paper* No. 2, 23 pp. (1921).—For a period of five months a Simmance total-heat recording calorimeter was supplied with town gas, and the readings of the recorder were compared with the value of the calorific power of the gas as detd. by means of the calorimeter forming part of the instrument. Occasional adjustments of the recorder pen were made, and it was found that the recorded values usually differed from the directly detd. values by less than 10 B. t. u. and seldom by as much as 15 B. t. u. On two occasions when a greater difference than this occurred, the discrepancy was traced to the accumulation of oxidized metal on the top of the gauze of the burner. The calorimeter was later supplied with various mixts. of coal gas, water gas, and H ranging in sp. gr. (air = 1) from 0.303 to 0.528, and in calorific value from 326 B. t. u. to 514 B. t. u. The greatest difference between the recorded calorific value and that detd. by an independent calorimeter was 16 B. t. u. With the calorimeter run on homogeneous gas, periodic variations occurring at intervals of about an hr. were observed and were due to the accumulation and subsequent sudden removal of air bubbles in the water circuit of the calorimeter. Occasional irregularities of the order of 20 B. t. u. were attributable to restriction of the water flow by particles of rust, etc. Expts. made in order to ascertain the origin of regular differences of the order ± 10 B. t. u. showed that the variations of recorded calorific values were roughly parallel with the variations in the gas factor for correcting the gas vol. to 60°F . and 30" pressure; that the rate of flow of gas through the meter varied proportionately with the gas factor, and that the claim that the gravity meter automatically corrects the flow of gas for varying pressure and density is substantially true; that variations of the external temp. caused a variation of the recorded calorific value amounting to ± 1.4 B. t. u. per $\pm 1^{\circ}\text{F}$.; and that owing to the change of viscosity of water with temp., a change of $\pm 1^{\circ}\text{F}$. in the water supply, produces a total effect on the recorder reading amounting in some cases to nearly $\pm 1\%$.

J. S. C. I.

Utilization of waste heat in gas works. E. G. STEWART. *Gas World* 75, 10-12 (1921); *Gas J.* 154, 734-5; 155, 27-8 (1921); *Engineering* 112, 77-8 (1921).—The available sources of waste heat are the sensible heat contained in the waste gases of retort furnaces, the blast products of water-gas generators, and the products leaving the plants. Any energy recovered from these sources could be applied to the generation of power for the plant by means of steam boilers and engines, and in the supply of steam to effect the reaction in water-gas manuf. Under carbonization, a ton of coal of 300 therms calorific value would yield 68 therms in form of gas, 148 as coke, and 17 as oil, or 78%. The remaining 22% is lost or used as follows: process losses 29 therms, sensible heat in the crude gas and tar vapors 6.8 therms, sensible heat in the flue gases 10 therms, sensible heat in the coke 9 therms, and heat required for power generation 12 therms. In water-gas manuf., out of 100 therms charged as coke into the generator, 8 therms are lost in radiation and convection, in hot ashes and coke dust, 10.3 therms in the sensible heat of escaping blast gases, 15.6 therms in the producer gas formed and wasted in the blowing period, 6.1 therms as sensible heat in the water gas and 27 therms in the steam used for the reaction and for running the plant. There is a thermal efficiency of 53% in the uncarbureted gas and 65% in carbureted gas. By use of waste-heat boilers in conjunction with the carbonization and water-gas processes, a saving of 0.2 d. to 0.7 d. per therm could be made.

J. L. WILEY

Steaming in vertical gas retorts. GEO. BRILBY. *Gas J.* 154, 542-48, 609-18 (1921); *Gas World* 74, 462-3 (1921); cf. *C. A.* 14, 2409.—A setting of 4 Glover-West vertical retorts was installed at the Research Station for carrying out expts. on steaming. An

analysis of the results shows that by moderate steaming at moderate temps. the output of therms in the form of gas of good and salable quality for the unit plant can be greatly increased, while the cost per therm will be correspondingly reduced. About 20-25% of steaming seems to be the practical limit, as after that point is reached, the effect of each individual % of steam falls off rapidly. As regards the products there is a gain in quantity except in the case of the coke which falls off both in amt. and quality. Tabulated data show that with 20% of steam and a retort temp. of 1248° as much as 33% of the total potential heat of Mitchell Main coal is converted into gas of a calorific value of 460 B. t. u. per cu. ft. The total gains from 1 ton of coal is gas 33 therms, tar 34 lb., and $(\text{NH}_4)_2\text{SO}_4$ 6 lb. To produce this result, the extra heat supplied amounted to 10 therms. With the same amt. of steam and a retort temp. of 1177°, 29% of the total potential heat of Lanarkshire coal was converted into gas of calorific value 432 B. t. u., with a gain in gas of 19 therms, tar 40 lb., and $(\text{NH}_4)_2\text{SO}_4$ 11 lb. The corresponding figures obtained at Uddingston last year were 26% of the total heat of the coal converted into gas of 447 B. t. u., and a gain of gas 17 therms, tar 39 lb., and $(\text{NH}_4)_2\text{SO}_4$ 2 lb. Consett coal is less suitable for steaming, yet the results are quite satisfactory; with 20% of steam and a retort temp. of 1248°, 26% of the total heat of the coal was converted into gas of 463 B. t. u., with a gain in gas of 11 therms, tar 17 lb., and $(\text{NH}_4)_2\text{SO}_4$ 7 lb. Steaming is also found to be a considerable aid to the thermal efficiency of the settings, but still the heat losses are too high. With the combustion chambers kept at a temp. of 1260°, the heat loss amounts to about 80% when working without steam, and 67% with 30% of steam. The amt. of heat required to maintain the carbonizing temp. of the settings at 1260° was found to be 12.4 therms per hr. There is no question that in coal carbonization greater economy and better results lie in control and regulation, and in saving or utilizing as much as possible of the present heat losses.

J. L. WILEY

Water gas. LEO VIGNON. *Ann. chim.* 15, 42-60(1921).—Gautier has found (*C. A.* 4, 2351) that moist CO and H_2 react to form small amts. of CH_4 , the proportions at 400°, after absorption of CO and CO_2 , being H_2 99.8% and CH_4 0.2%, and at 1300° 98.65% and 1.35%. V. has studied the catalytic effect of various mineral constituents of the ash of gas coke, etc., on the formation of CH_4 . Two samples of gas coke gave a mean ratio of H_2 to CH_4 in water gas of 96.55:3.45, while sugar charcoal gave 98:2. H_2O vapor reacts at lower temp. and more rapidly with a mixt. of C and CaO than with C alone. At 600-800°, H_2O vapor passed over 35 g. of CaO mixed with 10 g. of gas coke or lampblack, or 20 g. of sawdust, gave, respectively, 25.08, 25.50, and 23.50% of CH_4 in the water gas produced. Excess of H_2O decomposes CH_4 , giving CO and H_2 . Small amts. of C_2H_4 also appeared from 40% C with 60% CaO. The formation of CH_4 proceeds: $2\text{C} + 2\text{H}_2\text{O} \rightleftharpoons \text{CO}_2 + \text{CH}_4$, but as the reaction was carried out below the decompn. temp. of CaCO_3 , the CO_2 and CH_4 could be sepd. At 1050°, mixts. of 100 g. of coke with 10 g. of CaO gave 8.72-9.02% of CH_4 , the ratio of H_2 : CH_4 being 88:12. With 15 g. of CaO, the ratio was 81:19, while 50 g. of CaO gave a ratio of 77:23 at 1050°. Moist CO in contact with CaO at 950-1000° gave CO, CO_2 , and H_2 , the reactions being reversible at higher temps. A sample of water gas containing CO 23.6%, CO_2 9.6%, CH_4 2.1% and H_2 64.7% passed moist over CaO at 950° showed, after removal of CO_2 , CO 10.4%, CH_4 10.3% and H_2 79.3%, while a mixt. of 26% CO_2 and 74% H_2 passed moist over CaO at 950° gave CO 10.1%, CH_4 12.2%, and H_2 77.7% (CO_2 removed). Hence the following reactions take place: $\text{CO}_2 + \text{H}_2 \rightleftharpoons \text{CO} + \text{H}_2\text{O}$, and $\text{CO} + 4\text{H}_2 \rightleftharpoons \text{CH}_4 + 2\text{H}_2\text{O}$, being catalyzed by CaO above 900°, while below 800° the formation of CaCO_3 is an important factor. On passing CO of a purity of 98.6% over CaO, $\text{Ca}(\text{OH})_2$, or a mixt. of both, in a heated porcelain tube, there was no effect at 350°, but at about 400° hydrocarbons and H_2 were formed. Above 400° the hydro-

carbons diminished, and were practically absent at 600°, while H₂ increased. The reactions involved are $\text{CO} + \text{Ca(OH)}_2 \rightleftharpoons \text{CaCO}_3 + \text{H}_2$ (cf. Merz and Weith, *Ber.* 1, 718), $4\text{CO} + 2\text{Ca(OH)}_2 + \text{CaO} \rightleftharpoons \text{CH}_4 + 3\text{CaCO}_3$, and $8\text{CO} + 4\text{Ca(OH)}_2 + 2\text{CaO} \rightleftharpoons \text{C}_2\text{H}_4 + 2\text{H}_2 + 6\text{CaCO}_3$, the last two being new. The decompn. of $\text{Ca(HCO}_3)_2$ is probably also involved, since $2\text{CO} + \text{Ca(OH)}_2 \rightleftharpoons \text{Ca(HCO}_3)_2$. In fact, the latter at 360–370° yields CO₂ 20%, CO 27%, H₂ 51%, hydrocarbons calcd. as CH₄ 2%. With 1 or 2 mols. of CaO in excess, at 330–340° the decompn. of $\text{Ca(HCO}_3)_2$ gave CO 40 and 26%, H₂ 30 and 42%, CO₂ 6 and 0%, hydrocarbons as CH₄ 24 and 32%. Successive passages of moist CO over CaO gave a total of 99.5% of H₂ and hydrocarbons. Other catalysts used were Fe, Ni, Cu, SiO₂, Al₂O₃ and MgO. Moist CO and Fe at 250° gave, after removal of CO₂, a gas containing CO 91.7%, H₂ 1.0%, and CH₄ 7.3%, while at 1250° the products were CO 42.4%, H₂ 50.5%, and CH₄ 7.1%. Ni, Cu, and SiO₂ gave similar results, while Al₂O₃ gave only slight reduction of CO. The technical applications are briefly discussed.

M. R. SCHMIDT

Oxidation of low-temperature coal tar and its fractions under pressure. F. FISCHER and U. EHRHARDT. *Ges. Abhandl. Kennt. Kohle* 4, 280–92 (1919).—Low-temp. coal tar and also the fraction distg. below 270° were subjected to pressure oxidation in a continuous stream of air at 150° and 40 atm. pressure. The results left it uncertain whether the hydrocarbons as well as the phenols were oxidized. The product was a black lustrous pitchy product partly sol. in benzene. The oxidation product of the hydrocarbons separately treated contained a clear, limpid oil and also a reddish yellow oil which deposited solids when cooled, and dried in air like varnish. The hydrocarbons were thus attacked, although to a lesser extent than the phenols. In an expt. on the oxidation of the tar fraction up to 270°, the hydrocarbons were scarcely attacked at 100°, whereas the phenols were extensively changed into resins and acids. Pb oxide was found to have no catalytic effect, and the expt. throws light on the behavior of Pb phenolate paints. The Pb phenolate, partly by hydrolysis and partly by the action of CO₂, is slowly decomposed, forming free phenol, which is slowly oxidized. It seems probable that the oxidation products of low-temp. tar are suitable for use as *paints and varnishes*.

J. S. C. I.

Proportion of montan wax in low-temperature lignite tar and low-temperature tar paraffins. W. SCHNEIDER and O. JANTSCH. *Ges. Abhandl. Kennt. Kohle* 4, 363–72 (1919).—See C. A. 15, 1613.

E. H.

Centrifugal separator for tar. ANON. *Gas Age* 47, 512–13 (1921).—Description of the Sharples process for centrifugal dehydration of water-gas tar emulsion. It reduces the water content from around 3% to less than 1% depending upon the rate of feed. The total cost per gal. of sepd. tar is \$0.00793. About 125 gal. of tar emulsion can be treated per hr. per unit.

J. L. WILEY

Exhaust steam in gas works. JOHN A. RYAN. *Gas Record* 19, No. 12, 29–31 (1921).—Exhaust steam can be very profitably employed in gas-plant operation. By its use clinker troubles can be minimized and the capacity of the sets increased. It can be used in the process of concg. NH₃ and as an indirect heating medium for preheating light oils during the process of light-oil recovery from the gas.

J. L. WILEY

MacLaurin carbonization process. ANON. *Iron and Coal Trades Rev.* 102, 848–9 (1921); cf. *Ibid* July 7, 1916; C. A. 11, 2728, 2956.—Results of the low-temp. coking process obtained at Grangemouth indicate that the production of smokeless fuel is now within the range of commercial success. From coals of low ash content, a fuel with 4% volatile matter satisfactory for both domestic and boiler purposes is obtained, also about 20,000 cu. ft. of 200 B. t. u. gas, 20 gal. of oil, and 24 lbs. of NH₃ per ton of coal. With low-grade, high-ash coals it operates also satisfactorily, giving from 40–60,000 cu. ft. of power gas of about 150 B. t. u. and varying amts. of oil and NH₃.

It affords a satisfactory method for utilizing the waste material at the mines for producing a cheap gas for boiler fuel and at a good profit.

J. L. WILBY

New coke ovens at St. Louis. HECTOR PRUD'HOMME. *Gas Record* 19, No. 12, 19-23(1921).—Description and operating results of a block of 8 Plette ovens at the Laclede Gas Light Co.'s plant. These ovens are of the horizontal type with vertical flues and longitudinal heat regenerators working transversely. A 30-day test with 65% Elkhorn and 35% Pocahontas coal showed the following results: yield of coke 69.19%, proportion of foundry coke 38.15%, of domestic coke 61.85%; gas produced per lb. of coal 5.849 cu. ft., av. calorific value 564.5 B. t. u.; gas consumed for heating per lb. of coal 2.693 cu. ft., av. analysis: CO_2 1.7%, C_2H_4 3.3, O 0.4, H 51.8, CO 6.0, CH_4 29.7, N 6.8; by-products per ton of coal, NH_3 5.6 lb., tar 7 gal. and benzene 3.4 gal.

J. L. WILBY

Electrostatic precipitation applied to blast-furnace gases (BUSH) 4. Pressure oxidation of phenols (FISCHER, SCHRADER) 26.

BERTELSMANN, W.: La production du gaz déclairage. Paris: Ch. Beranger 15 rue des Saints-Peres. For review see *Ann. chim. anal.* 3, 195(1921).

BOCHARDTJUN, KARL: Die neue Zeit und die Zukunft der deutschen Gaswerke. Berlin: Friedenau Deutscher Kommunal Verlag. G.m.b.H. For review see *Z. Ver. Gas Wasserfach.* 60, 31(1920).

BOOT, WM. H.: Fuel Economy. London: Rentel & Co. 92 pp. 2/6 sh. For review see *Chem. Weekblad.* 18, 352(1921).

DIETZ, LUDWIG: Lehrbuch der Lüftungs und Heizungstechnik. München und Berlin: R. Oldenbourg. 710 pp. M 75. For review see *Tonind. Zig.* 45, 655(1921).

HAUSDING, A.: Handbuch der Torfgewinnung und Torfverwertung. Berlin: Paul Parey 577 pp. For review see pp. *Ver. Gas Wasserfach.* 61, 60(1921).

Coal briquet. R. A. KRATOCHWILL. U. S. 1,376,706, May 3. Briquets are formed of coal dust bonded with gum arabic and coated with varnish.

Stabilized liquid and solid fuel mixture. L. W. BATES. U. S. 1,375,811, Apr. 26. Asphaltic and free C particles in liquid hydrocarbon fuel oil mixts. are stabilized by the addition of a peptizing agent such as coal-tar creosote and lime-rosin grease. The action is promoted by heating the mixt. to a temp. of about 95° or somewhat lower.

Tar and ammonia from producer gas. J. BECKER. U. S. 1,375,483, Apr. 19. Producer gas is cooled and dust and tar are pptd. from it and $(\text{NH}_4)_2\text{SO}_4$ is then directly pptd. by passing the gas through an acid wash the evapn. of which is effected by the gas passing through it.

Tar and ammonia from coke-oven gas. J. BECKER. U. S. 1,375,484, Apr. 19. Tar is extd. from coke-oven gas and the gas is concurrently cooled by passing it counter-current with air. The cooled gas is passed through an acid wash to absorb NH_3 , the mother liquor from the acid wash is discharged into a satn. bath and the heated air from the tar-extn. process is passed through the satn. bath to effect evapn. and deposition of $(\text{NH}_4)_2\text{SO}_4$.

Tar and ammonia from producer gas. J. BECKER. U. S. 1,375,485, Apr. 19. Tar-freed producer gas, at about its satn. temp., is passed through an acid wash to absorb NH_3 , the mother liquor from the acid wash is conveyed to a satn. bath and superheated air is passed through the latter to effect deposition of $(\text{NH}_4)_2\text{SO}_4$. Air from the satn. bath is reheated and conveyed to the producer.

Tar and ammonia from producer gas. J. VAN ACKEREN. U. S. 1,375,475, Apr. 19. Producer gas is concurrently cooled while the dust is pptd. from the hot gas. It is then further cooled and washed with H_2O and the residue of the tar is pptd. from the partially

cooled but still hot gas. The gas is then passed through an acid wash to absorb the NH_3 . U. S. 1,375,476 relates to a process in which a heat exchange is effected between hot producer gas and H_2O to cool the gas and generate steam, after which tar and NH_3 are removed from the cooled gas. The steam generated is mixed with the air going to the producer to augment the production of NH_3 in the producer and heat generated by combustion of the tar- and NH_3 -freed gas is used to superheat the steam-charged air. U. S. 1,375,477 relates to a process in which tar-freed producer gas, at about its satn. temp., is passed through an acid wash to absorb NH_3 while H_2O is at the same time pptd. from the gas. The dil. mother liquor from the acid wash is conveyed to a satn. bath and superheated air is passed through the latter to effect deposition of $(\text{NH}_4)_2\text{SO}_4$ and sat. the air with substantially the full content of moisture required for the manuf. of producer gas and this moistened air is then fed to the producer. U. S. 1,375,478 relates to a process in which dust-freed gas, at a temp. above its satn. point, is passed through an NH_3 liquor condensate to effect distn. of NH_3 , after which the commingled gas and still vapors are passed through an elec. precipitator to ppt. the tar residue from the gas and then passed through an acid wash to absorb both the NH_3 of the original gas and that obtained from the distn.

Recovering cyanogen compounds. E. V. ESPENHAHN. U. S. reissue 15,090, Apr. 19. See original patent 1,315,219, C. A. 13, 3004. The pat. relates especially to the production of HCN and cyanides from coal gas.

Fuel-feeding and distributing device for gas producers. H. NIELSEN and F. D. MARSHALL. U. S. 1,376,567, May 3.

Apparatus for producing carbon from natural gas. E. W. SHULL. U. S. 1,375,234, Apr. 19.

Destructive distillation of coal, peat or similar materials. G. F. RENDALL. U. S. 1,376,532, May 3. A retort is charged with coal or similar material to be distd., hermetically sealed and supplied with steam until the air is exhausted from the retort. The retort is then externally heated and vapors are withdrawn by means of superheated steam and condensed. The residue in the retort is cooled by wet steam before its removal. This mode of operation serves to facilitate sepn. and recovery of the various products formed.

Distilling tar oils, resins, mineral oils, etc. CHEMISCHE FABRIKEN WORMS AKT. GES. Brit. 156,255, Jan. 4, 1921; cf. C. A. 15, 1807. In distg. tar oils, resins, mineral oils, etc., the yield of low-boiling distillates is increased and the formation of coke is diminished, by adding to the material undergoing distn. a catalyst such as an acid, salt, metal, metal compd., or a base. The prior use of O compds. of P and B, and salts thereof is referred to. Suitable substances are CaCl_2 , NaOH , AlCl_3 , NaOAc , water glass, H_2SO_4 , Cu or Al powder, oxalic acid, kieselguhr, pptd. silica, and double salts. The materials, prior to distn., may be heated for some hrs. in an open reflux app., or in closed vessels under pressure. During distn. indifferent gases or vapors may be passed through the still. The b. p. of the distillates may be lowered by repeating the distn. The temp. is kept at 20–25°. Preliminary treatment of NH_3 -still liquor may include settling, filtration through material containing Fe_2O_3 , e. g., blast-furnace slag used for the treatment of mine water, and treatment for the removal of cyanogen compds.

Coke oven. J. BECKER. U. S. 1,374,546, Apr. 12.

22—PETROLEUM, ASPHALT AND WOOD PRODUCTS

F. M. ROGERS

Statistical review of the Mid-Continent field from 1912 to 1920 inclusive. M. BATES and B. H. LASKY. *Nat. Petroleum News* 13, No. 13, 67–79(1921).—An ex-

haustive report containing data regarding consumption, production, wells drilled, dry holes, costs of drilling, and of materials, etc., for the Mid-Continent field from 1912 to 1920 inclusive.

R. L. SIBLEY

A résumé of the oil shale industry, with an outline of methods of distillation. EARL A. TRAGER. *Bull. Am. Assoc. Petroleum Geol.* 4, 59-65(1920).—A review is given of the production and consumption of petroleum in the U. S. since 1911. The first shale oil production recorded was in 1694, from English shale. First shale oil in France in 1830 when Laurent obtained paraffin by the distn. of bituminous shales. In 1857 there were about 50 companies producing oil from bituminous shales and coal. Deposits of shale are known in the U. S. in Ky., Mont., Nev., Calif., Colo., Utah, Wyo. In Colo., shale beds total 6 ft. in thickness and will yield more than 15,000 t. of oil shale per acre. Av. oil content is 48.5 gals. per t. or about 17,325 barrels of oil per acre. For preliminary or field distns., crush the shale to pass through $\frac{1}{4}$ inch sieve, mix and weigh out exactly 8.5 ounces (240.0 g.). Place this in a one-quart Hg retort connected to an iron condenser. Heat until no more oil distills out. Collect the distillate in a graduated cylinder. Each cc. of water or oil collected is equiv. to 1 gal. per ton. Gas is measured by a wet-test gas meter. Nitrogen is detd. by a method similar to that outlined in U. S. Bureau of Mines, *Tech. Paper No. 64*. Shale oil is fractionated in 3% cuts until a temp. of 300° has been reached.

R. T. GOODWIN

The petroleum industry of Poland. S. JANICKI. *Petroleum Times* 5, 759-62(1921).—The history and present conditions of the oil industry in Galicia are given. Statistics regarding production of the various fields since 1900 are included.

R. L. SIBLEY

The distillation of oil shale. A. H. LOW. *Petroleum Times* 5, 689-90(1921).—A description of a process for the preliminary testing of oil shales with oil as the primary consideration as adopted in the Colorado School of Mines.

R. L. SIBLEY

Losses in the dehydration of oil. J. H. WIGGINS. *Nat. Petroleum News* 13, No. 26, 59-65(1921).—Tests were carried out with a dehydrator plant in which the emulsified oil was passed through hot H₂O heated by steam coils. The plant was divided into 2 dehydrator tanks and 3 stock tanks. The depth of the oil was such that it remained in the first tank about 2 hrs., in the second about 6 hrs. and in the third stage or stock-tank stage about 12 hrs. during a 24-hr. test. Curves show that at the lower temps. (84° and 105° F.) the loss in the third stage is very much greater than in the other two stages. At 125° F. the proportion of the loss has decreased and at 150° F. the loss in the stock tank is less than the loss in the second stage. The loss increased at an almost const. rate until 125° F. was reached in the dehydrator, at which temp. most of the more volatile fractions have been eliminated. At 200° F., the usual temp. for dehydrators, the loss becomes 8.5%. If the incoming oil had an av. sp. gr. of 37.55° Bé., when the dehydrator reached 84° F., the sp. gr. dropped 0.65° Bé. and when the temp. increased to 150° F., the oil leaving had a sp. gr. of 35.60° Bé.

R. L. SIBLEY

Reducing losses by evaporation. C. P. BUCK. *Oil and Gas J.* 20, No. 5, 80-1 (1921); cf. C. A. 14, 2547—Comments on Bureau of Mines, *Bull. No. 200* (J. H. Wiggins). A type of dehydration filter, depending for its performance on the greater capillary adhesion of oil to fibrous material to break the tension of the oil film surrounding the H₂O bubbles and thereby breaking the emulsion, if operated at 84° F., will save nearly 4% in vol. over oil treated in a dehydrating steaming plant at 150° F. It is urged that some metallic tank material be developed at reasonable prices to replace the wooden ones now used in the dehydrating processes so that the volatiles may be recovered. The producer should equip his lease so as to provide vapor tight tanks but inasmuch as the pipe lines will accept only sufficiently "weathered" product, it may be necessary to introduce a new topping service to conserve the volatile easily recoverable by the producer.

R. L. SIBLEY

Blended gasoline containing casinghead gasoline. F. BORDAS. *Ann. fuls.* 13, 530-43 (1920).—In view of recent importations into France of blended gasoline, investigations have been instituted by the Ministry of Finance to differentiate between these spirits and straight run gasoline, in view of the increased fire risks and the marked heavy residue. Modifications of the current tests are described. J. S. C. I.

Lamp method for determining sulfur in benzine. A modified form of apparatus. J. S. JACKSON AND A. W. RICHARDSON. *J. Inst. Petroleum Tech.* 7, 26-34 (1921).—In the lamp described, the ordinary wick is replaced by a bundle of capillaries which are "spread" by a central air tube lightly jammed into position; the air supply does not pass through the benzine, so that fractionation is greatly reduced, and the current of air escaping from the top of the air tube produces a slight reduction in pressure, thus assisting the action of the capillaries and enabling them to supply sufficient benzine to maintain a strong non-luminous flame. A mixing chamber is provided above the tops of the capillaries and the luminosity and size of the flame are controlled by the air supply. J. S. C. I.

Proposed A.S.T.M. distillation test for gasoline, kerosene methods. ANON. *Nat. Petroleum News* 13, No. 24, 33-4 (1921).—A tentative method of a distn. test for gasoline, naptha, kerosene and similar petroleum products. R. L. SIBLEY

Durability of electric heaters for gasoline distillation. W. A. JACOBS AND E. W. DEAN. *Bur. of Mines. Repts. of Investigations* No. 2131, 2 pp. (1920).—Recent tests show the life of the commercial heater to be practically the same as the Bureau of Mines heater. The former failed because of disintegration of the insulating material holding the resistance wire, which allows short circuiting. The Bur. of Mines heater failed through destruction of the wire, which burned out. D. K. FRENCH

Bureau of Mines method for determining water in petroleum. E. W. DEAN AND W. A. JACOBS. *Bur. of Mines. Repts. of Investigations* No. 2159, 3 pp. (1920).—Following the original publication of the method the Bureau of Mines has gathered data as to chemical supply houses handling the glass ware specified, substitutes for the elec. hot plate described, and also two alloy compns. as substitutes for the Ni-Cr compn. previously used. D. K. FRENCH

Action of oxidizing agents on vaseline and paraffins. A. LANGER. *Chem. Ztg.* 45, 466 (1921).—Yellow "vaseline oil" mixed with concd. NaOH was shaken during 3 days with KMnO_4 and the supernatant oil removed. The sludge was dissolved in dil. H_2SO_4 , giving an oil which was only partly sol. in Na_2CO_3 or dil. NaOH. Heated on the steam bath with concd. H_2SO_4 this oil evolved SO_2 and gave an apparently cryst. mass, insol. in all ordinary solvents, and in spite of careful removal of H_2SO_4 , giving SO_2 on burning. The portion of oil freed from alkali-sol. constituents showed similar behavior. NaClO prep'd. from 5 parts of bleaching powder and 6 parts of NaOH in 40 parts of H_2O gave no better results as an oxidizer. Liquid paraffin of the German Pharmacopeia, treated for a long time with concd. H_2SO_4 to remove impurities, and oxidized with alk. KMnO_4 , gave products similar to those from vaseline oil. The unoxidized oil with concd. H_2SO_4 gave the usual shining black sulfo compds. When liquid paraffin was oxidized in H_2SO_4 with KMnO_4 until undissolved Mn_2O_3 remained, and the insol. mass after removal of MnSO_4 was dissolved in dil. HCl, a soft resin was obtained. The recovered oil from the alk. oxidation of paraffin oil, re-oxidized in acid soln., gave a brittle resin softening at 75° , which yielded SO_2 and blackened when treated with concd. H_2SO_4 ; unaffected by cold KOH, but on boiling going partly into soln. and emitting a conifer-like odor; easily sol. in C_6H_6 , CHCl_3 , ethylene chlorides, turpentine, EtOH, Et_2O , and Me_2CO ; difficultly sol. in heavy benzine, CCl_4 and MeOH. On dissolving the alk. sludge from the alk. KMnO_4 oxidation in HCl, a soft resin resembling gum turpentine was obtained. Cl forms resins with paraffin oil, the addition of $\text{K}_2\text{Cr}_2\text{O}_7$

favoring the formation of solid products. With $K_2Cr_2O_7$ and HCl, the reaction tends to be violent and must be conducted carefully. By heating 2 parts of paraffin oil with 2.5 parts of HNO_3 , d. 1.486, for 10 hrs. at $90-100^\circ$, adding 0.5 parts of HNO_3 and heating 2 hrs. more, solids were obtained which, dissolved in 15% KOH and acidified with HCl, gave a 75% yield of resinous brown fatty acids. Yellow vaseline and paraffin wax also were used, as well as oils recovered from the oxidation of vaseline oil and liquid paraffin, the latter two giving scarcely any unsaponifiable residue after treatment with alkali. The oxidation product of paraffin wax is ointment-like, and on boiling with PbO , gives an ether-sol. Pb salt, which indicates acids of the oleic series. Vaseline on oxidation gives a solid and an ointment-like resin, the latter containing no acid constituents.

M. R. SCHMIDT

By-products of forest industries. CH. GROUND. *Papier* 24, 250-3(1921).—Dead leaves have been shown to be suitable for the manuf. of paper, but this is practical only where they can be collected mechanically. The process of prepn. of "vegetable wool" from pine needles is described. It yields as by-products a water suitable for medicinal baths, an essential oil recommended in the treatment of rheumatism, gout and indurations, a resinous soap, and a viscous, gelatinous, very bitter and very aromatic residue suitable for the manuf. of green soap. When heated this residue yields a diuretic and sudorific. It can also give a highly prized carbon-black. It is suggested that the residues from the prepn. of chestnut and quebracho exts. be used for papermaking.

A. P.-C.

Wood distillation. III. Distillation of some Mysore and Baroda woods and of certain waste products. J. J. SUDBOROUGH, H. E. WATSON, M. N. BARUGUNA, K. R. DOTIWALA, M. G. KEKRE, M. O. KRISHNASWAMY, M. K. NARASIMHAN, AND S. M. NILIKANI. *J. Indian Inst. Sci.* 3, 281-92(1920); cf. *C. A.* 14, 3652.—The distn. of a further 23 species of Mysore woods and 8 species of Baroda woods gave results similar to those previously obtained (cf. *C. A.* 14, 3526), i. e., the yields of AcOH and MeOH were generally lower than those obtained on distg. European and American hardwoods. The yields from the Baroda woods were, as a rule, lower than those from the corresponding Mysore woods. Undried coconut shells yielded 4.90-6.90% of AcOH and 0.66-1.54% of MeOH; wattle wood (*Acacia decurrens*), the bark of which is utilized for the extn. of tannin, gave yields which compared favorably with those obtained from hardwoods; myrobalan kernels, the husks from the dry pods of the gold mohur tree (*Poinciana regia*), and bamboo gave yields comparable with those from the South Indian jungle woods. **IV. Tar from coconut shells.** J. J. SUDBOROUGH, H. E. WATSON, AND M. K. NARASIMHAN. *Ibid.* 293-306.—The tar from coconut shells yielded on distn. about 24% of aq. distillate with 8% of AcOH and 44% of oils volatile below 260° which gave 30% of phenolic substances soluble in NaOH soln. These substances on fractionation yielded 6.2% of phenol and 5.86% of creosote, b. p. $200-230^\circ$, contg. 0.43% of guaiacol, the yields all being calcd. on the wt. of the tar. The sp. gr. of the creosote, however, was lower than that required by either the Brit. or U. S. Pharm. J. S. C. I.

Extraction of turpentine, resin and gum from the gum-oleoresin of *Boswellia serrata* (FOWLER, MALANDKAR) 26. Wood carbonization at Steyning (FOTTELL) 21. Distilling tar oils, mineral oils, etc. (Brit. pat. 156,255) 21. Clarifying and decolorizing oils (U. S. pat. 1,377,021) 27.

MASMEJEAN, A., AND BEREHARE, E.: Le petrole son utilisation comme combustible. Paris: Dunod. Quai des Grands-Augustins 47. 232 pp. 40 fr. For review see *Rev. electrochim.* 15, 133(1921).

Cracking hydrocarbon oils. W. M. McCOMB. U. S. 1,374,858, Apr. 12. Hydrocarbon oils are converted into products of lower b. p. by passing a mixt. of the oil with a smaller proportion of steam through a heated tubular vessel or coil of progressively increasing temp. from its inlet to its outlet end, the temp. of the oil therein at a point adjacent the inlet end of the coil being approx. the initial b. p. of the oil under treatment and the temp. of the oil at a point adjacent the outlet end being approx. the end b. p. of the oil under treatment. The temp. of the oil at intermediate points in the coil increases approx. in the same ratio with respect to the total intervening length of the coil under consideration as the b.-p. temps. of the oil under treatment increase in ordinary fractional distn. throughout the successive positions of its b.-p. range. This treatment is stated to produce but little fixed gas and C.

Motor-fuel from hydrocarbon oils. J. R. McCABE. U. S. 1,376,713, May 3. A hydrocarbon oil is heated and the vapors from it are mixed with H and passed through metal tubes in which they are subjected to high-frequency elec. discharges passed transversely through the tubes.

Blended fuel from natural gas and liquid hydrocarbons. E. C. D'YARMETT. U. S. 1,376,925, May 3. Natural gas is introduced under pressure into a heated body of liquid hydrocarbon material such as crude petroleum and the vapors of the liquid and gas are permitted to commingle above the surface of the liquid under pressure and the condensible portion of the blended materials is cooled to effect condensation and produce a fuel adapted for use in internal-combustion engines.

Preventing deposition of carbon in hydrocarbon vapor generators. J. R. KENDALL. U. S. 1,376,100, Apr. 26. A generator supplying hydrocarbon vapor intermittently to a burner, and containing BaO, is heated in the presence of air to a temp. at which BaO₂ is formed. A hydrocarbon mixed with air, CO₂ and H₂O vapor in small amt. is then fed to the generator to produce hydrocarbon vapor and form additional BaO₂ and the vapor is then burned outside the generator further to heat the latter and reconvert the BaO₂ to BaO with liberation of O and oxidation of deposited C. During the cooling when the generator is shut off, the BaO is partially reconverted to BaO₂.

Petroleum-still. A. D. SMITH. U. S. 1,374,402, Apr. 12. The oil circulates through a series of tubes forming the lower portion of the still and through an upper horizontal drum having a sloping bottom to lessen deposition of C and promote flow of the contents of the still.

Apparatus for distilling hydrocarbon oils. S. F. STEPHENS. U. S. 1,375,427, Apr. 19. The oil is fed on to a rotating plate within the still, spread as a film on the plate and flung from the edge of the plate against the inner surface of the still wall in the form of a spray.

Inclined tubular oil-still. D. L. NEWTON and N. H. ANDERSON. U. S. 1,376,631, May 3. The still has steam coils in its lower portion where they will be completely submerged in the oil.

Distilling hydrocarbon oils. W. C. AVERILL, JR. U. S. 1,375,245, Apr. 19. Pale lubricating oil and distillates containing gasoline are produced from asphaltic petroleum oil of high S content such as "Gulf coast crude petroleum" by heating the bottom of the still directly by products of combustion, cooling a portion of the combustion products after they have passed beneath the still, passing this cooled portion of the gases through the material within the still while it is heated from below, and condensing the hydrocarbon vapors driven off.

Air-cooled fractional condenser for hydrocarbon oil vapors. J. W. COAST, JR. U. S. 1,374,357, Apr. 12.

Electric treatment of liquid fuel. E. E. WICKERSHAM. U. S. 1,376,180, Apr. 26.

The end b. p. of liquid fuels such as kerosene, crude oil or gasoline is lowered by passing elec. sparks through the fuel, *e. g.*, as it flows from a fuel tank to a carburetor.

Destructive distillation of wood. E. M. SAWTELL. U. S. 1,374,887, Apr. 12. A mixt. of shavings and sawdust is fed into the top of a retort in which distn. and restricted combustion take place from the lower portion of the charge and the distn. products pass upward through the fresh material introduced to the charge and thence to a system of fractional condensers.

Apparatus for the destructive distillation and carbonization of sawdust, peat or similar materials. H. N. McLEOD. U. S. 1,375,714, Apr. 26. The material undergoing destructive distn. and carbonization is passed successively through a series of superposed horizontal retort tubes.

Furnaces and retorts for dry distillation and carbonization of wood or similar materials. T. M. U. VON POST. U. S. 1,375,943-4, Apr. 26.

Paraffin wax; lubricating oils. E. ERDMANN. Brit. 156,694, Jan. 6, 1921. Paraffin wax and viscous lubricating oils are sepd. from lignite tar, coal tar, shale tar, etc., by adding acetone or a homolog such as methyl ethyl ketone, or EtOAc which ppts. the paraffin wax. A hard wax is sepd. by cooling to 0°, and a further quantity of softer wax by further cooling to -20°. Lubricating oil is obtained by removing acetone and volatile oils from the residue by treatment with superheated steam at 200-250° or by heating *in vacuo*. The volatile fractions may be sepd. by preliminary treatment of the tar with superheated steam. The paraffin wax is refined by dissolving it in a solvent, such as the volatile fractions obtained from the tar, treating with H₂SO₄ and soda lye and pptg. by addition of acetone.

23—CELLULOSE AND PAPER

A. D. LITTLE

The synthesis of cellulose. K. HESS. *Z. angew. Chem.* 34, Aufsatzteil, 49-51 (1920).—An address.

C. J. WESS

Decomposition of cellulose by aerobic bacteria. J. GROENWEGE. *Med. Geneesk. Lab. Welterreden* 1920, 163-269.—There are two views as to the decompn. of cellulose in nature: one that it is anaerobic and brought about by organisms which are not positively detd. the other that it is aerobic and brought about by two groups of organisms, one group decomposing cellulose directly, the other group being denitrifying organisms. Extensive expts. were carried out from the second point of view, all the cultures being made aerobically. A septic tank liquid and earth were used as the sources of the organisms. The culture medium consisted of tap water to which were added 2% of filter paper, 0.25% of KNO₃, and 0.05% of K₂HPO₄. When this medium was inoculated with either of the substances mentioned and incubated at 37° gas was given off, the nitrate was reduced to nitrite and to NO, and the paper was reduced to a pulp; if at this stage the soln. was poured off from the pulp and fresh medium (without filter paper) added, reduction of nitrate again took place, and the pulp was gradually dissolved. The organisms in these cultures were sub-cultivated on agar plates and pure cultures obtained. These were found to fall into 3 groups: those which effected denitrification but did not attack cellulose; those which did not denitrify but attacked cellulose; and those which did neither. The first group contained *Bacillus viscosus* and *B. opalescens*, and the second group *B. cellaresolvens* α , β , and γ . Cultivations of each member of one group with each member of the other group were made and full details of the results are given. It is concluded that the 3 varieties of *B. cellaresolvens* attack cellulose, and that the decompn. products serve as food for the denitrifying organisms, *B. opalescens* and *B. viscosus*, the complete process being thus a symbiotic one. The end products

of cellulose decompn. are acetic, butyric, and lactic acids, which are oxidized to CO_2 and water by the denitrifying organisms. It is suggested that the decompn. of the cellulose may be brought about by an enzyme, cellulase. J. S. C. I.

Increasing the tensile strength of cellulose hydrate. F. BECK, DAHLEM. *Z. angew. Chem.* 34, Aufsatzteil, 113-4(1921).—The use of a neutral solvent, such as $\text{Ca}(\text{CNS})_2$ at 120° , is advocated. The strength of the product is increased by treating the strips a 2nd time with a soln. of sp. gr. 1.36, and is still greater if the solvent is not completely removed by washing with water. Herzog (*Ibid* 151) disclaims that this work originated in his lab. C. J. W.

Cellulose. KARL FREUDENBERG. *Ber.* 54B, 767-72(1921).—A yield of cellobiose octa-acetate corresponding to the presence of 35-36% of cellobiose in the original material can be obtained in a single operation by treating 10 g. cellulose with a mixt. of 37 cc. Ac_2O and 5.5 cc. concd. H_2SO_4 at room temp. (ice for the 1st 8 hrs.) for about 13 days. An indirect detn. of the loss of octa-acetate which occurs during the process makes it appear probable that the cellulose mol. is composed of more than 60% cellobiose. This is not in harmony with the recent view of Hess (*C. A.* 15, 751) but it is in agreement with the hypothesis that cellulose is built up of cellobiose residues arranged in a uniform polysaccharide chain of ten or more members. C. J. WEST

Cellulose. III. Asymmetric structure of cellulose and the influence of ammoniacal copper hydroxide (Schweizer's reagent) on the rotation of carbohydrates. KURT HESS AND ERNST MESSMER. Karlsruhe. *Ber.* 54B, 834-41(1921).—The observation of Levallois, that solns. of cellulose in ammoniacal $\text{Cu}(\text{OH})_2$ soln. are optically active, is confirmed. With 0.4 g. cellulose in 12% NH_4OH with 0.6 g. $\text{Cu}(\text{OH})_2$ in 100 cc. soln., the value of $[\alpha]$ was found to be about -950° to -1000° . The regenerated cellulose in HCl soln. is optically inactive, as are also Et_2O solns. of ethylcellulose, aq. alk. solns. of xanthate cellulose, and jellies of cellulose in neutral salt solns. Cellulose presents, therefore, a marked example of "latent asymmetry," thus resembling mannitol, and it appears that Schweizer's reagent behaves towards cellulose in the same way that boric acid does towards the simpler carbohydrates. C. J. WEST

Oxy- and hydrocellulose. HANS PRINGSHEIM. Berlin. *Cellulosechemie* 2, No. 5, 57-61(1921).—A general review of the constitution of these compds., in which they are likened to the reducing dextrins except that they possess a higher degree of polymerization. The formation of oxycellulose is analogous to that of hydrocellulose. C. J. WEST

The acetylation of wood pulp (cellulose). W. NAUCK. *Cellulosechemie* 2, No. 5, 61-3(1921).—N. discusses the proposition that, in the prepn. of acetates from wood pulp, the physical properties are probably more important than the chemical compn. Of special importance is the degree of division of the material. The best result is obtained by using a mixt. of H_2SO_4 , Ac_2O and AcOH with very finely divided pulp. Another factor is the penetrability of the cellulose fiber by non-aq. liquids, in which the "specific surface" plays a part; the larger this is, the more readily the acetolysis proceeds. In this connection, the "specific surface" of cotton is more favorable than that of wood pulp. C. J. WEST

Differentiation of hydroxy- and hydrocelluloses by titration. CARL G. SCHWALBE AND ERNST BECKER. Versuchstation f. Zellstoff- u. Holzchemie, Eberswalde. *Ber.* 54B, 545-50(1921).—The hydrocelluloses, which are formed by hydrolysis, consist of a mixt. of cellulose with dextrin-like degradation products of the latter and contain larger or smaller amts. of free aldehyde groups. The hydroxycelluloses are similar mixts. but chiefly formed by oxidation and as a result contain, besides the CHO groups resulting from the sugar residues, further CHOH groups which can be oxidized to aldehyde or keto groups. Very probably the CHO groups are further oxidized to CO_2H . Insofar as the resulting acids are easily sol. in H_2O they can no longer be found in the finished

hydroxycellulose, being washed out in the prepn. of the latter, but insol. or difficultly sol. acids, with mol. wts. approximating that of cellulose, are still present. To det. whether the acid nature of hydroxycelluloses might be utilized in differentiating them from hydrocelluloses, at least in the pure state, different hydroxycelluloses were compared titrimetrically with a hydrocellulose prepd. by Girard's method with 5% H_2SO_4 . Four samples of hydroxycellulose (the prepn. of which will be described elsewhere) were used: from cotton with bleaching powder, with $KMnO_4$, and with H_2O_2 , and from cellulose with bleaching powder. One g. of the air-dry material, suspended in about 50 cc. H_2O , was titrated with 0.01 N $NaOH$ and litmus or phenolphthalein (the latter at about 80°). In the bleaching powder prepn. from cellulose the acidity found was small relative to the considerable oxidation and CO_2H formation indicated by the high Cu no. and high soly. in alkali. The high ash content made it seem probable that the acid groups in the hydroxycellulose were neutralized by the $CaCO_3$ formed in drying the bleaching powder soln. in the air; the acid thus neutralized could be detd. by ashing the hydroxycellulose and titrating the ash. Taking this alkalinity of the ash into consideration, it was found that there is indeed a great difference between hydroxy- and hydrocelluloses, 1 g. of the 4 samples of hydroxycellulose requiring 41.4, 27.7, 10.4 and 33.4 cc. of 0.01 N $NaOH$ as against 4.6 cc. for the hydrocellulose, 1.8 for cotton, 4.1 for cellulose, 7.0 for unbleached cellulose, 7.1 for normally bleached cellulose and 14.9 for overbleached cellulose. For a qual. differentiation, the prepus. suspended in H_2O are treated with a few drops of Me orange, which almost always gives a yellow color (only with the two most highly acid hydroxycelluloses was the color reddish orange), and a few cc. of concd. $NaCl$ are added: in the case of hydrocellulose and the ordinary celluloses the color changes not at all or hardly perceptibly while with the hydroxycelluloses it becomes a strong wine-red.

CHAS. A. ROUELLER

Digestion experiments with alumina. ERIK WAHLBERG. *Zellstoffchem. Abhandlungen* 1, No. 5, 124(1921).—While wood appears to be decomposed by boiling with Na_2AlO_3 , the recovery process is such that it has little practical interest. Cf. C. A. 14, 2856.

C. J. WEST

Simplifying the methods for the investigation of plant materials. CARL G. SCHWALBE. *Zellstoff und Papier* 1, 1-5(1921).—S. discusses the prepn. of the material for analysis, the detn. of H_2O , ash, resins, fats and waxes, furfural and methylfurfural, and pectin (MeOH). The discussion is in the nature of a supplement to the report of the committee, rendered in 1920.

C. J. WEST

Comparative determination of the alkali content of straw pulp. ERN. HEUSER AND THEODOR BLASWILER. *Papierfabr.* 19, 509-514(1921).—Two kinds of alkali are considered, that extd. by H_2O and that detd. by further extn. with acids, or the total alkali and the bound alkali. There is very little free alkali (difference of the two) in washed straw pulp.

C. J. WEST

The cellulose content of pine wood. PETER KLASON. *Zellstoffchem. Abhandlungen* 1, No. 5, 105-114(1921).—Cross and Bevan's method cannot be used for the detn. of the cellulose content of pine wood. K. has investigated the action of bisulfite (80 g. $NaHSO_3$ and 500 cc. N HCl made up to 1 l.) for varying periods of time at 100°. After 8 days the cellulose reaches a nearly const. value, and, with continued heating, only slowly decreases (1.7% in 13 days). He finds 53% cellulose in pine wood. The compn. of woods of various ages is also investigated.

C. J. WEST

Bleaching studies on wood pulp. I. CARL G. SCHWALBE AND ERNST BECKER. *Zellstoffchem. Abhandlungen* 1, No. 5, 115-21(1921).—This is the 1st of an elaborate series of studies upon the effect of bleaching agents, the pulps and slimes being completely analyzed. The significance of the various figures is discussed.

C. J. WEST

Methyl red as indicator in the titration of sulfite liquors. PER ROSENBLUND.

Zellstoffchem. Abhandlungen 1, No. 5, 121-3(1921).—Methyl red may be used as an indicator in the modified Hohn method for the titration of fresh sulfite liquors.

C. J. WEST

Studies on the African "da" hemp (*Hibiscus cannabinus*); its value for paper making. F. HERIG, L. MATROD AND F. MORHAU. *Bull. P. office colonial* 12, 247-58, 321-41(1919); *Bull. Agr. Intelligence* 10, 1140-1.—This plant yields a seed containing 17 to 20% of an oil suitable for food and soap making. It has a fiber excellent for cording and sacking, and the fiber yields 55% of a fine grade of paper cellulose.

T. G. PHILLIPS

Use of warm-ground mechanical pulp in the manufacture of paper. FR. RÜHLER-MANN. *Papierfabr.* 19, 393-4(1921); *Paper Trade J.* 72, No. 27, 40, 42(1921).—Warm-ground wood pulp is better for the manuf. of newsprint than cold-ground pulp.

C. J. WEST

Iodine solution in paper microscopy. G. WISBAR. *Mitt. kgl. Materialprüfungsamt* 38, 316(1920); *Papier-Ztg.* 46, No. 24, 1098-9(1921); *Papierfabr.* 19, 399(1921).—General discussion of the various I solns. and their uses.

C. J. WEST

The silica content of the reed. FR. HERIG. *Cellulosechemie* 2, 44-47(1921).—The whole plant has about 5.83% ash, of which about 76% is SiO_2 . This may play a part in the physiol. behavior of the plant and may lend strength to the stalk. Most of the SiO_2 is dissolved out in the process of digestion and the bleached pulp contains no larger % of SiO_2 than many other fibers.

C. J. WEST

The steam turbine in the paper mill. A. G. GROUNDWATER. *Paper Makers' Monthly J.* 59, 155-8(1921).—G. discusses various kind of drives (electric, mechanical and combinations), and the utilization of the reducing turbine and back-pressure turbine.

C. J. WEST

Paper pulp supplies from India. WILLIAM RAITT. *Paper Makers' Monthly J.* 59, 184-7(1921).—India, with its bamboo and Savannah grasses, the only two species commercially adapted to papermaking, can supply the world with 13 millions tons of pulp per year. The period of rotation with bamboo is 3-5 yrs., with the grasses, 2-3 yrs. The process of fractional digestion as applied to bamboo is discussed. Also in *J. Roy. Soc. Arts.* 69, 508-21(1921).

C. J. WEST

Recent developments in papermaking. T. D. NUTTALL. *World's Paper Trade Rev.* 75, 1314-1318(1921); *Paper Makers' Monthly J.* 59, 198-203(1921).—N. discusses the relation of the width of the paper machine and its speed.

C. J. WEST

Perishing of paper in Indian libraries. J. J. SUDBOROUGH AND M. M. MEHTA. *J. Indian Inst. Sci.* 3, 119-226(1920).—Paper in Indian libraries, especially in Plains stations such as Calcutta, Madras, and Bombay, will not withstand the climate; it perishes very rapidly. This is more noticeable with papers prep'd. from wood pulp, and especially those in which the fibers have been weakened because of the different treatments to which they have been subjected. The addition of As_2S_3 as a preservative is useless, because, although it preserves paper from the ravages of insects, it accelerates the perishing of the fibers. Paper used for books which have to be preserved in stations like those of the Indian Plains should be prep'd. only from strong rag fibers, should have no distinct acidity, and should withstand a severe test in the folding machine. Its contents of rosin and filling materials should be below certain fixed values. The rag fibers should not be weakened by prolonged digestion with alkali or by over-bleaching and care should be taken to remove the last traces of bleaching agent and of free acid.

J. S. C. I.

By-products of forest industries (GROUP) 22. Polysaccharides. III. Cellulose (KARRER, WIDMER) 10. Waterproofing porous materials (U. S. pat. 1,376,553) 18.

Reducing viscosity of solutions of cellulose esters. C. CARLSSON and E. THALL. U. S. 1,375,208, Apr. 19. See Brit. 136,141 (C. A. 14, 1219).

Sugars from cellulose. R. A. KOCHER. U. S. 1,374,928, Apr. 19. See Norw. 29680 (C. A. 14, 1897).

Apparatus for bleaching fibrous pulp. H. E. ELLIS. U. S. 1,375,285, Apr. 19.

Apparatus for drying wood-pulp or similar materials. J. D. ULLGREN. U. S. 1,376,659, May. 3

Absorbent sheets of wood fiber. R. KRON. U. S. 1,376,285, Apr. 26. A cheap fiber adapted for making absorbent roofing sheets which are satd. with tar or the like is prepd. by boiling relatively large pieces of wood or similar material in H_2O without addition of acids or alkalies, or steaming, and then rolling, crushing and grinding to obtain the natural cellulose fibers undeteriorated by chem. treatment.

Manufacture of paper and similar sheet materials. J. C. PRABODY. U. S. 1,376,353, Apr. 26. Fibers, *e. g.*, hemp, jute or wood fibers are suspended in H_2O and there is added a quantity of alk. cellulose thiocarbonate or similar material to produce a mixt. of proper concn. This is then formed on a machine in which the fiber stock is further dild. but without substantially altering the concn. of the added material.

Sulfate pulp. E. OLSSON. U. S. 1,375,759, Apr. 26. A cooking liquor containing NaOH and Na sulfide is used in the manuf. of sulfate pulp to obtain a high yield of pulp.

Treating waste liquor from soda pulp manufacture. A. H. WHITE. U. S. 1,374,889, Apr. 12. Waste liquor from soda pulp manuf. is treated with sufficient CaO to heat autogenously the mixt. formed to at least 200° and to prevent the temp. from rising above 425° owing to the endothermic reactions which are caused with the $Ca(OH)_2$ at this temp. Three lbs. of lime may be added for each lb. of H_2O in the liquor or 1.5 lbs. CaO to each lb. of 40° Bé. liquor. Before the mixt. heats up sufficiently to distil off valuable products it is placed in a rotary retort, still hot from a preceding charge and the retort may be externally heated to facilitate the commencement of the destructive distn. When the latter is initiated, it continues exothermically with production of H_2O , MeOH, acetone and other products. During the later stage of the distn., as the temp. rises to about 425° , light oils are produced, which float upon the alc. soln. Tarry products are almost entirely absent from the distillates. The solid residue is of a light brown color unless subjected to undue exposure to the max. distn. temps., when it darkens and evolves tarry products. The light brown residue catches fire easily in the air and burns to a white ash, under favorable operation, with regeneration of most of the CaO, or under less favorable conditions to a dark ash, which yields NaOH on leaching. The calcined ash contains some Na_2CO_3 and may be mixed with additional liquor of a succeeding batch in order to increase its final yield of Na_2CO_3 recoverable by leaching the ash.

Separating fiber from waste liquors of paper mills. N. PEDERSEN. U. S. 1,376,459, May 3. Fibers are recovered from waste paper mill liquor by stirring the liquor while introducing into it a gas, *e. g.*, air or waste gases, under pressure, and then discharging the liquor and permitting liberation of the gas, which causes flotation of the fiber particles.

Paper coated with leaf metal. F. TSCHIEKE. U. S. 1,376,737, May 3. A layer of paper is united to a layer of leaf Al or other leaf metal by an adhesive such as a resin which possesses its max. adhesiveness at a raised temp. and another stronger adhesive in contact with the metal leaf.

24—EXPLOSIVES AND EXPLOSIONS

CHARLES E. MUNROE

Identification of explosives by determining their critical temperature of solution. L. CRISWEN. *Bull. soc. chim. Belg.* 29, 28–33 (1920).—Detn. of the crit. temp. of soln.

provides a simple, rapid, and accurate method of identifying explosives. 2 g. of the substance is heated with 0.9–1.8 cc. of 95% alc. till dissolved, and the temp. at which sepn. occurs on cooling is noted. The crit. temp. of soln. of α -mononitronaphthalene is 44°, and of trinitrotoluene, 96.5°.

J. S. C. I.

Critical temperature of solution of tetranitromethylaniline [tetryl]. L. CRISMER AND J. TIMMERMANS. *Bull. soc. chim. Belg.* 29, 34–5(1920).—In a German explosive the presence of tetranitromethylaniline was confirmed by a detn. of its crit. temp. of soln., which is 105°.

J. S. C. I.

Acetone fermentation process (FOWLER, *et al*) 16.

Explosive. F. OLSEN. U. S. 1,376,029, Apr. 26. An explosive adapted for use in blasting in mines, etc., is formed of NH_4ClO_4 , TNT and nitrocellulose, with or without wood meal, paraffin, vegetable ivory, nitrates, MnO_2 , ferro-Si or NaCl.

Explosives containing nitrourea or its compounds. B. F. HALVORSEN. U. S. 1,375,588, Apr. 19. Nitro derivs. of urea such as $\text{NH}_2\text{CONHNO}_2$ constitute strong and brisant explosives highly resistant to blows and shocks as do also compds. in which one of the H atoms of the nitrourea is replaced by a metal or org. base. The nitrourea may be prepd. by treating urea nitrate with concd. H_2SO_4 at a low temp. The urea nitrate used may be formed by treating CaCN_2 with H_2O , pptg. Ca from the soln. with CO_2 and reacting on the filtered soln. with HNO_3 .

Explosive. F. OLSEN. U. S. 1,376,030, Apr. 26. An explosive containing nitro-starch, *e. g.*, "Trojan" grenade or mortar shell powder, is mixed with a propellant powder such as ordinary smokeless powder in order to form an explosive suitable for ordinary blasting.

Nitrostarch. G. R. ANCHORS. U. S. 1,376,598, May 3. Starch or a puffed cereal to be nitrated is placed in a nitrating vessel and the nitrating acids are then introduced from the bottom of the vessel in order to displace air from the material. Cf. C. A. 14, 1045.

Liquid-air explosive. G. WEBER. U. S. 1,375,243, Apr. 19. An absorbent mixt. for prep. liquid-air explosives is formed of a combustible org. absorbent material such as sawdust, cotton or coal mixed with blast-furnace dust. The blast-furnace dust serves as an absorbent. Al or Mg may be added.

Preventing explosions in grain elevators. R. T. F. DODDS. U. S. 1,376,082, Apr. 26. For prevention of explosions in grain elevators, additional H_2O vapor is supplied to the interior of the elevators during their filling, at progressively higher levels as the bins become filled.

Masses for use in flame-throwing devices. R. FIEDLER. Ger. 310,148, Feb. 21, 1918. Guncotton is dissolved in thioether; this soln. is gelatinized with CS_2 and a suitable hydrocarbon. P, S and the like, alone or in combination with an O carrier, may be incorporated by mechanical mixt.

25—DYES AND TEXTILE CHEMISTRY

L. A. OLNEY

The pyrazolone dyestuffs. J. A. WILSON. *Textile Colorist* 43, 242–3(1921).—A brief discussion of their manuf. and use.

CHAS. E. MULLIN

Lists of dyes which are controlled by patents owned by the Chemical Foundation, Inc. ANON. *Textile Colorist* 43, 263–4(1921).—The dyes are listed by name. Schultz and patent numbers, and expiration date are given.

CHAS. E. MULLIN

Some improvements in alizarin red printing pastes. RAFFAELLE SANSOMER. *Textile Colorist* 43, 253-4(1921).—Two formulas for alizarin and one for chrome red pastes are given.

CHAS. E. MULLIN

Control of chemic. EDWIN W. ADAMS. *Textile Colorist* 43, 259-62(1921).—Some variations in available Cl of chemic liquors from that shown by sp. gr., as actually found in mill practice, and a volumetric method of detn. suitable for use in the mill, are given.

CHAS. E. MULLIN

Classification and identification of coal tar dyes. CIRC. of the chief and chemists of the Service des Finances. *Ann. fals.* 13, 193-456(1920); *Analyst* 46, 63.—Methods are described for sepg. the dyes into groups with a view to their subsequent identification, and suitable tests are described. An alphabetical list of the dyes is also given. The paper is unsuitable for abstraction, and the original should be consulted.

H. G.

Ingrain dyes on fibers [wool] by means of nitroso derivatives. WAHL AND GUINON. *Rev. gén. mat. col.* 24, 179-82(1920).—Wool is dyed full bright shades, ranging from brown through reddish black to black, by immersion for 1 hr. in a boiling dye-bath which is acidified preferably with AcOH and contains a nitrosophenol- or nitrosoanaphthol-sulfonic acid (2 mols.) and a diamine (1 mol.). Dyeings so obtained are not fast to rubbing and soaping, but are rendered faster, without much change in shade, by after treatment with bichromate and H_2SO_4 . Suitable diamines are diaminodiphenylmethane, benzidine, *p*-phenylenediamine, aminodiphenylamine, and naphthylenediamines.

J. S. C. I.

On the dyeing of all-wool shoe and gaiter felts. J. A. WILSON. *Textile Colorist* 43, 187-8(1921).—A list of suitable dyes is given.

CHAS. E. MULLIN

The nitrate discharge method on indigo. J. A. WILSON. *Textile Colorist* 43, 177-8(1921).—A formula is given. Cf. *C. A.* 4, 2735.

CHAS. E. MULLIN

Glove dyeing. B. WALTHER. *Deut. Färber-Ztg.* 57, 529-30(1921).—For black, 40 to 60 g. of fat-sol. nigrosine is dissolved in one liter of C_6H_6 . Alc. may be used in place of C_6H_6 if an alc.-sol. nigrosine is used. For colored shades, Cevesfarben are employed such as "Brilliant-scharlach fettloslich, Chrysoidinbase, Cevesgelb 3, Bismarckbraun k. fettloslich, Cevesviolett 1 Base." With these dyes from 20 to 60 g., according to the depth of shade desired, are dissolved in one liter of C_6H_6 or alc. Gloves dyed by this method have a dull appearance which is brightened by rubbing with a little vaseline or white wax. A luster pomade is prepd. by melting wax, and after it is removed from the flame adding an equal wt. of C_6H_6 . A very thin coating of this pomade is quickly applied by means of a cloth. Gloves dyed in a bath consisting of 60 g. nigrosine base, 100 solid paraffin, and 800 C_6H_6 show a luster by rubbing with a soft cloth. In the prepn. of this dye the paraffin is first melted, the nigrosine added and the mixt. heated until uniform; then it is removed from the flame and C_6H_6 is added with vigorous stirring. Should any of the paraffin sep. the dish containing the dye is placed in hot water. Toluene, xylene, petroleum benzene, $CHCl_3$, and CCl_4 may be used in place of C_6H_6 . Especial care should be taken that the goods are perfectly dry before dyeing.

L. W. RIGGS

Process for printing colored discharges by means of sulfur dyestuffs. E. JUSTIN-MUELLER. *Rev. gén. mat. col.* 24, 85-6(1920).—A suitable printing paste is prepd. by mixing 20 cc. of NaOH of 38° B. (sp. gr. 1.38) with the dyestuff, adding 250 cc. of boiling water and 100 g. of dextrin, and heating the mixt. for 20-30 mins. on a water bath until the reduction of the dyestuff is complete. For difficultly reducible dyes, the addition of 20 g. of sugar, glucose, or molasses, etc., is necessary. For printing on white grounds, the mixt. is diluted to 1 l. with neutral starch thickening contg. 15 g. of Hydraldite C extra. A greater amt. of Hydraldite must be used for the discharging of grounds dyed with azo dyestuffs. Good results are only obtained if the printing paste is not

strongly alk. and if the reducing agent used is not easily oxidizable. The printed fabric is steamed for 3–4 mins. at 102°, washed, and soaped. J. S. C. I.

Process for rapidly developing the full bright tone of fabrics dyed with sulfur dyes. E. JUSTIN-MULLER. Soc. ind. Mulhouse, sealed note No. 1804. *Rev. gén. mat. col.* 25, 5 (1921).—The process is applied, after dyeing and washing, to the goods in appropriate app. as follows: a bath is made to contain 2 to 3% of the wt. of the textile as NaHSO_3 (38 Bé.) and 1 to 1.5% as NaOH (38 Bé.). The reaction is slightly alk. to litmus, or if not is made so by cautious addition of NaOH . The goods, according to material, are treated 10 to 20 min. in the cold bath, squeezed and dried without rinsing. This bath, besides brightening and unifying the tint, eliminates traces of milk of S which may be left in the fiber by the dyeing process. This treatment completely develops colors which are only developed on the fiber, such as immediate blues C and C R. This note is to safeguard priority in the employment of alkali sulfites for the immediate brightening of S colors and is distinct from the complete development of certain S blues.

L. W. RIGGS

Cotton dyeing. ALBERT WINTER. *Deut. Farber-Ztg.* 57, 491–2, 512 (1921).—A detailed description is given of the dyeing of various forms of cotton with substantive or benzidine, basic and sulfur dyes, to produce light, medium or dark shades.

L. W. RIGGS

Application of aniline black to cotton. ANON. *Am. Dyestuff Rep.* 8, No. 23, Sec. 2, 16–17 (1921).—**Warm method.**—For 90 kg. of cotton the dyebath contains the following: water 1300 kg., HCl (34° Tw.) 40, aniline oil 10, $\text{K}_2\text{Cr}_2\text{O}_7$ 9 to 14. In place of 40 kg. HCl , 24 of the HCl and 6 of H_2SO_4 (168° Tw.) may be used. The intensity of the color is always regulated by the amt. of aniline employed. The aniline and HCl are dild. slightly with water and mixed in a glazed earthenware vessel, then added to the 1300 kg. of water in the bath. The chromate is dissolved separately and added. The cotton is worked 1 hr. in the cold or until it has acquired a considerable intensity of color, when the temp. is gradually raised to 50 to 60° and continued 1–1.5 hrs. Another method is to dye the cotton cold for 1 hr. with the bath at one-half strength, then add the remaining half of the chemicals and continue dyeing in the cold 1 hr., after which the temp. is gradually raised to 50 to 60° and the dyeing continued 1 hr. The temp. must be raised very gradually or much of the color will be pptd. in the bath and not on the fiber. After dyeing the cotton must be well washed with water, boiled in a soln. containing 5 to 10 g. of soap per liter, with or without the addition of a little Na_2CO_3 , and finally dried. **Cold method.**—For 90 kg. of cotton use HCl 16 to 20 kg., H_2SO_4 20, aniline oil 8 to 10, $\text{K}_2\text{Cr}_2\text{O}_7$ 14 to 20, and FeSO_4 10. The amt. of water should be much smaller than in the warm method, otherwise the dyeing would be incomplete or would take too long. FeSO_4 is added to render the black less liable to turn green. In the cold process it is recommended to dye 1 hr. at one-half concn., remove the goods, add the remaining chemicals and dye 90 min. longer. To make the black perfectly ungreenable the dyed cotton after washing is given a supplementary oxidation. The oxidizing stock liquor contains FeSO_4 20 kg., $\text{K}_2\text{Cr}_2\text{O}_7$ 5, H_2SO_4 (168 Tw.) 15 to 18, H_2O 80. Add 1 kg. of this mixt. to 100 kg. water, work the goods 45 min. at 64°, wash, boil with soap and dry. Other methods are described.

L. W. RIGGS

Method for weighting and dyeing silk. A. TYSKA. *Textilber. Wiss. Ind. u. Handel* 2, 128–9 (1921).—Silk is prepd. by steeping it in water at 40° for 1 hr., boiling in a 30–35% soap soln., washing, and souring with HCl . The silk is weighted 80–100% by immersing it 4 times alternately in SnCl_4 soln. of 80° B. (sp. gr. 2.43) and Na_2HPO_4 soln. of 7° B. (sp. gr. 1.052) and washing after each immersion. The weighted silk is treated with a warm soap soln. for 1 hr., and without washing is dyed black in a bath contg. 100% (on weight of silk) of soap and 100% of "logwood crystals." The temp. of

the bath is raised from 62 to 75° during $\frac{3}{4}$ hr., 5% of aniline is added, the temp. is increased to 92° during $\frac{3}{4}$ hr., and so maintained for 1 hr. The dyed silk is well washed, treated for $\frac{3}{4}$ hr. in a warm boiled-off soap bath to which AcOH and 0.3% of Water Blue have been added, and finally brightened with oil and citric acid.

J. S. C. I.

Use of caustic potash in mercerization. E. RISTENPART. *Textilber. Wiss. Ind. u. Handel* 2, 130-1(1921).—Cotton was immersed without tension for 5 mins. in a caustic alkali soln., mangled, washed 3 times in water, immersed in water overnight, soured with AcOH, and dried at the ordinary temp. Comparative tests with solns. of NaOH and KOH showed that the Na and K alkali-cellulose compds. have similar properties. In very concd. solns., NaOH (owing to its greater viscosity) has less mercerizing effect than KOH, but under the usual conditions 1 g.-mol. of NaOH is equal to $1\frac{1}{2}$ g.-mols. of KOH.

J. S. C. I.

Removing certain stains. T. C. N. BROEKSMIT. Amsterdam. *Pharm. Weekblad* 58, 703-4(1921).—Expts. with various reagents for removing stains from cotton and wool gave results as shown:

Stain.	Reagent.	Result.
iron rust	oxalate soln.	+
	pyrophosphate and boric acid	—
iron-gallate ink	oxalate soln.	+
	pyrophosphate and boric acid (if stain is fresh)	+
	pyrophosphate	—
aniline ink	NaOCl and boric acid	+
alk. pyrogallol	KMnO ₄ (after treatment with H ₂ O ₂ and H ₂ SO ₄)	+
resorcinol-iron soln.	H ₂ O ₂	+
pyrogallol-iron soln.	H ₂ SO ₄	+
AgNO ₃	tincture of I (after treatment with Na ₂ S ₂ O ₄)	+
protargol	KCN	+
picric acid	magnesia alba and medicated soap	+
tar	alcoholic soap and 50% alcohol.	+
Peru balsam		

In cases where a yellow stain is left by the reagent it may usually be removed with oxalate or H₂O₂.

JULIAN F. SMITH

Rapid method for cutting microscope sections of cotton yarns and fabrics. R. S. WILLOWS AND A. C. ALEXANDER. *J. Textile Inst.* 12, 99-100(1921).—Solns. of cellulose nitrate and acetate are suitable for mounting sections of loose fibers, yarns, and fabrics. Two solns. of the acetate are used; (a) a viscous sirup in acetone, and (b) 5-6 g. dissolved in 100 cc. of acetone. The fibers under examn. are immersed for 1 hr. in (b). A clean microscopic slide is painted with a layer of (b), nearly dried, two or more layers of (a) are added and on these the sample fiber is placed. More layers of (a) are then added, the slide is dried over CaCl₂ so as to obtain a clear film, then hung in acetone vapor until the film becomes soft, and this is removed and embedded in paraffin wax of m. p. 40-5°. In order to observe "Ball's growth rings," the section of a coarse cotton yarn is washed with xylol and abs. alc., and stuck to the slide with a smear of albumin (white of egg 25 cc., glycerol 25 cc., and Na salicylate 1 g.) without heat. The slide is held in acetone vapor till the dope softens and is then immersed in acetone for 2 hrs. to remove the dope, whereby each fiber stands freely on end on the slide. NaOH of 45° Tw. (sp. gr. 1.225) is allowed to pass under the cover slip and the growth rings may then be observed.

J. S. C. I.

Action of water on wool. A. REYCHLER. *Bull. soc. chim. Belg.* 29, 291-300(1920):—On heating wool to temps. up to 150° with water or alk. or acid solns., under normal or increased pressure, acid or basic substances pass into soln. which are pptd. by fuchsin and form lakes with eosin or ponceau. The undissolved wool has lost the property of double refraction between crossed nicols, and can be powdered when dry. If wool is heated to 110-120° with water, its elasticity is diminished, but it is still very tenacious, and its plastic properties at these temps. are utilized in finishing processes. The relative insensitiveness to acids of methyl orange dyed on wool or silk, which is even more marked at high temps., is due to the combination of the indicator with a system which, although not markedly basic, is capable of combining with acid mols. J. S. C. I.

The fan palm of southern Annam and its fiber. AUG. CHEVALIER AND P. BUSSY. *Bull. agr. inst. sci. Saigon* 1, 377-80(1919); *Bull. Agr. Intelligence* 11, 325-6.—This palm, *Corypha lacvis*, used by the natives for thatching, sail making, etc., gives promise of providing a valuable fiber. T. G. PHILLIPS

The cultivation of fiber plants in Indo-China: Agave Cantala. I. AUG. CHEVALIER. *Bull. agr. inst. sci. Saigon* 1, 266-70(1919).—C. discusses the possibility of growing fiber in Indo-China and the identity of *Agave cantala*. II. G. VERNET. *Ibid* 1, 270-6(1919); *Bull. Agr. Intelligence* 11, 192-6.—The habits of growth of *A. cantala*, the compn. of its leaves, and the possibility of its cultivation are treated. Trials are being started in various provinces. T. G. PHILLIPS

Present position and future prospects of the natural indigo industry (DAVIS) 15.
A study of the indigo soils of Bihar (DAVIS) 15.

BEAUMONT, ROBERTS: **Woolen and Worsted.** 4th Ed. revized and enlarged. New York: D. Van Nostrand Co. 716 pp. \$10. For review see *Am. Dyestuff Rep.* 9, 29(1921).

Azo dyes dyeing with chromium mordants. C. JAGERSPACHER. U. S. 1,375,701, Apr. 26. By combining aromatic *o*-hydroxydiazio compds. with 1, 8-dihydroxysulfonaphthalene carboxylic acids, dyes are obtained suitable for printing cotton with Cr mordants. They constitute dark powders which dissolve in H₂O with red-violet to blue colorations and in concd. H₂SO₄ with violet to green-blue colorations, dye wool in an acid bath violet tints becoming, on subsequent chroming, fast blue to black, and produce fast blue to black prints when printed on cotton with Cr mordants. 2-Diazo-6-nitro-4-methyl-1-hydroxybenzene and 1, 8-dihydroxy-3-sulfo-6-naphthalene-carboxylic acid or similar compds. may be used as starting materials. Cf. C. A. 14, 354.

Dyeing with basic colors. A. LENDLE. U. S. 1,375,919, Apr. 26. Basic colors such as methyl violet or malachite green are fixed upon cotton, wool, jute, silk or other fibers, so as to be fast to sunlight, by an "after-treatment" of the dyed material with Na phosphotungstate or Na phosphomolybdate or similar compds.

Two-tone dyeing of piece goods. H. NOLL. U. S. 1,376,569, May 3. A two-tone dyeing on satin goods is effected by first dyeing a part of the raw silk with a fast color-resisting dye, weaving this dyed silk with raw undyed silk so that the colored silk will appear on one surface of the goods and the raw silk on the opposite surface, and then dyeing the uncolored surface.

Warp-dyeing apparatus. W. F. HASKELL. U. S. 1,375,389, Apr. 19.

Apparatus for dyeing tops, yarn and similar materials. A. ASHWORTH. U. S. 1,374,628, Apr. 12. Collapsible tubular yarn spools are mounted on a perforated pipe through which dye soln. is circulated.

Yarn reel or spool for use in dyeing. A. ASHWORTH. U. S. 1,374,543, Apr. 12.

Retting fibrous straw. J. M. MASSON. U. S. 1,374,941, Apr. 19. Fibrous straw such as flax is retted by immersing and boiling it in a soln. containing Na_2PO_4 and sulfonated castor oil or a similar sulfonated oil and is subsequently washed.

Viscose silk. E. BRONNERT. U. S. 1,374,718, Apr. 12. Viscose silk threads up to 1 denier in fineness are produced by spinning raw viscose with phenol-aldehyde condensation products in a bisulfite bath, the concn. of the bath being inversely proportional to the thread fineness to be produced.

Viscose silk. E. BRONNERT. U. S. 1,376,672, May 3. A soln. containing H_2SO_4 and lactic acid is employed as a spinning bath in the manuf. of viscose silk, the quantity of lactic acid in the soln. being proportioned inversely to the age of the viscose to be treated and the H_2SO_4 being directly proportioned to the fineness of the thread to be produced. The bath may contain H_2SO_4 135, lactic acid 10 and H_2O 855 parts for 7 denier threads.

Forming threads or other articles from viscose, etc. B. BORZYKOWSKI. U. S. 1,375,823, Apr. 26. A viscose or cellulose soln. is formed into threads, films or the like and set in a non-acid salt soln., e. g., a soln. formed of NaOH or $(\text{NH}_4)_2\text{SO}_4$, and is then immediately converted into a final cellulose product by the action of H_2SO_4 .

Forming threads from cellulose solutions. B. BORZYKOWSKI. U. S. 1,375,824, Apr. 26. Threads of cellulose solns. are spun into an alk. bath such as a soln. formed from caustic alkali and the thread is withdrawn from the bath and wound under tension and simultaneously converted into cellulose hydrate by the action of H_2SO_4 .

Recovering salts from precipitation baths employed in artificial silk manufacture. E. BRONNERT. U. S. 1,376,671, May 3. Salts formed in H_2SO_4 pptn. baths containing dissolved sulfates used in the manuf. of artificial silk from viscose solns. are converted into metal hydrogen sulfates by lixiviating the threads with H_2SO_4 in order to facilitate the soln. of the salts. A 10-12% H_2SO_4 soln. is preferred.

Waterproofing threads and fabrics. L. G. R. AUZENAT. U. S. 1,377,110, May 3. Threads and fabrics such as artificial silk the strength of which decreases when moistened are waterproofed and strengthened by treatment with a plurality of gases such as turpentine and HOAc vapor and ozonized air which react together to produce a substance impermeable to H_2O .

26—PAINTS, VARNISHES AND RESINS

A. H. SABIN

Brightness decrease of radioactive paints. G. BERNDT. *Z. tech. Physik* 1, 102-7(1920); *Science Abstracts* 24A, 196.—B., acquainted only with the measurements of Marsden and Rutherford, made expts., interrupted after 9 months. The first 7 samples (a) contained from 0.2 to 0.02 mg. of Ra per g. of a certain Zn sulfide, 3 other samples (b) contained 0.1 mg. Ra, 0.5 mg. mesothorium + 0.5 mg. radiothorium, and 0.066 mg. radiothorium, resp., per g. of another Zn sulfide. Rutherford's formula is confirmed; the const. A is, however, found not to be proportional to the Ra percentage, but to increase at a slower than linear rate. Assuming the relation to hold generally, the brightness would, in a period of 5 years, in the (a) samples, decrease very little in the weakest Ra preps., but sink to 20% and less in the preps. contg. 0.025 mg. Ra and more. In the (b) preps. decrease to less than 20% was more rapid. It was noticed that a luminous paint prepd. with dry ZnS darkened much more slowly than when prepd. with aq. soln. of the salts.

H. G.

Lithopone, its history and manufacture. JOHN S. WILLIAMS, JR. *Rubber Age* 9, 167-8(1921).—A popular description of the process of manuf. of lithopone. J. B. T.

The measurement of the consistency of varnish. H. A. GARDNER AND P. C.

HOLDY. Paint Mfrs. Assoc. of U. S., *Circ.* 127, 51 pp. (June, 1921).—The authors define viscosity, plasticity, rigidity, and viscous and plastic flow. Of the viscometers in general use the air-bubble type gives relative values for the consistency of varnishes, which are sufficiently accurate for control work. The falling-wt. type is not generally used for varnishes. The gravity-efflux type such as the Engler, Saybolt, and Redwood instruments, are unsuitable for varnishes because of exptl. difficulties which makes an accurate detn. impossible; and since the pressure cannot be varied the consistency of plastic varnishes cannot be measured. Abs. viscosities obtained with the Bingham variable pressure plastometer (*C. A.* 14, 1047) fitted with a modified receiver, on 37 different varnishes of various types ranged from 0.6 to 5.5 poises at 25°; these are tabulated against results obtained with the MacMichael and Doolittle torsion viscometers. Details of the operation of the instruments, calcn. of the capillary const. of the plastometer, discussion of accuracy, etc., are given. The MacMichael operated at accurately controlled low speeds and temp., might be used for research and routine work but it is not as accurate as the plastometer and exhibits a tendency to indicate viscosities lower than the true values. The Doolittle appears best adapted for routine testing although its readings cannot be calcd. to abs. viscosities. The Stormer and the Hadfield-Bawtree (*C. A.* 15, 180) viscometers are described. Most of the varnishes received directly from the mfrs. were only very slightly if at all plastic, but several bought on the open market showed comparatively high yield values. The occurrence of plasticity in varnishes cannot well be explained on the hypothesis of solid friction, because ultra-microscopic examn. shows very few solid particles; but it may be due to emulsoid aggregates forming a continuous structure through the varnish. While plasticity is desirable in paint, it is not necessary in a varnish; the slight apparent yield-values obtained on some varnishes may, however, be due to surface tension, kinetic energy losses, etc. on the instrumental results. The mechanical agitation of the torsion instruments might be sufficient to break down the structure or colloidal body of varnishes and be the cause of discordance observed on repeat detns. Panel exposure tests made on all the varnishes show that viscosity does not influence durability, although one might expect a varnish of high viscosity which produces a thick film, to show a strong tendency to crack or check with atm. changes. If high viscosity does not result in greater durability or higher decorative value, it appears advantageous to produce a varnish as low in viscosity as is compatible with good working properties and adequate protection. A tabulation of the no. of colloidal particles in the various varnishes, counted under the ultramicroscope shows a wide variation, and great differences in particle size. The viscosity of varnishes is sufficient almost completely to prevent Brownian movement. The samples of high viscosity either showed a very large no. of small particles or a smaller no. of very large particles. Some varnishes tend to become plastic with time; this is no doubt the result of colloidal change, and is probably a condition to be avoided.

F. A. WERTZ

A standardized apparatus for air-bubble consistency. H. A. GARDNER AND P. C. HOLDY. Paint Mfrs. Assoc. of U. S., *Circ.* 128, 7 pp. (June, 1921).—For routine detn. of consistency of varnishes by the air-bubble method, the authors have produced a set of 20 tubes contg. mineral oils covering a range of viscosities from 0.5 to 5.5 poises at 25°. Any two adjacent tubes represent a difference of about 0.5 bubble or 0.25 poises. The glass tubes are carefully selected to be 13.35 mm. (± 0.05 mm.) outside diam. with walls of equal thickness, and 110 mm. long. Pure mineral oils were found to be the most permanent available standard liquid and with an accurate abs. viscosity measurement on a few of these, the series of tubes can be made by blending the oils and calcn. the intermediate viscosities. For most work a series of ten tubes with one bubble difference between adjacent tubes, will be sufficiently accurate.

F. A. WERTZ

Colloid mills and ultra filters; their operation and application. ISMAR GINSBERG. *Oil, Paint and Drug Rep.* 100, No. 1, 24, 84(1921).—G. gives a general description with drawings, of the colloid mill as patented by Plauson and Block (*C. A.* 9, 2574, 2585; 14, 3129) with sketches of plant installation for extg. oil from shale. (See also *C. A.* 15, 2137.) F. A. WERTZ

Extraction of turpentine, resin and gum from the gum-oleoresin of *Boswellia serrata* without the use of solvents. G. J. FOWLER AND M. A. MALANDKAR. *J. Ind. Inst. Sci.* 4, 27-42(1921).—The turpentine is first removed from the oleoresin by distn. with wet steam. The yield amounted to 8-9%, and the oil, which was pale yellow, had the following consts: sp. gr. 0.8435 at 30°, $[\alpha]_D = +4^\circ 54'$, fraction distg. below 160° 81%, 160-80° 14.4%. The gum-resin remaining after the removal of the turpentine is heated with about 3 times its wt. of water in an autoclave at 30 lb. pressure, whereby the hydrated resin rises to the surface and solidifies on cooling, while the gum forms a flocculent ppt. or mucilage on the bottom of the vessel. The resin after dehydration by heating to about 130° forms a brown transparent mass, amounting to 54% of the original gum-resin and not differing appreciably in appearance from that extd. by a solvent. It has the following consts: acid value 51.6, sapon. value 61.3, I value 108.1. The gum on drying forms a dark gray mass, amounting to 23% of the original gum resin. It forms a mucilage with water of but feeble adhesive power. J. S. C. I.

Pressure oxidation of phenols. F. FISCHER AND H. SCHRADER. *Ges. Abhandl. Kennt. Kohle* 4, 293-309(1919); cf. *C. A.* 15, 1613.—The oxidation of phenols by air under 45 atm. pressure was examd. to see if resinous substances were obtainable, with the ultimate object of producing substances similar to bakelite from the phenols of low-temp. tar without the use of CH_2O . The products obtained were partly insol. condensation products and partly degradation products. Under suitable conditions fairly clear resinous substances were obtained, the color being dependent on the reaction and concn. of the original mixt. Phenol at 100° in presence of a 2.5 N soda soln. yielded a considerable quantity of brown resinous product, but less at 150-200°. The 3 isomeric cresols were oxidized in presence of soda soln. and *o*-cresol in presence of an excess of NaOH. Coloring matters and degradation products were obtained, but little resinous matter. The coloring matters were apparently fuchsin derivs. resulting from condensation of cresol and aldehydes. In presence of $\text{N H}_2\text{SO}_4$ above 150° *o*-cresol was extensively oxidized, yielding solid products. At 150° the products were a hard, lustrous, orange-colored resin, sol. in benzene and alc., and also a brown substance insol. in benzene, and small quantities of coloring matter. J. S. C. I.

The encouragement of German rosin production. WILHELM POLLMANN. *Chem. Ztg.* 45, 459-9(1921).—P. takes exception to the present method for protecting the German rosin industry, which consists of turning over to the "Rosin Society" 3% of all rosin imported; and suggests efficient production as a more satisfactory method. The working of the rosin plantations with complete utilization of by-products according to the most economical American procedure is described. F. A. WERTZ

Oxidation of low-temperature coal tar and its fractions under pressure (FISCHER, FERRHARDT) 21. Distilling tar oils, resins, etc. (Brit. pat. 156,255) 21.

SANSONE, A.: *Chimie de la teinture*. Paris: J. Hermann. 410 pp. For review see *Chimie & Industrie* 5, 747(1921).

Paint vehicle. W. N. BLAKEMAN, JR. U. S. 1,375,352, Apr. 19. A vehicle for manuf. of paints is formed of tung oil, hydrogenated linseed oil, linseed oil and marine animal oil.

Paint. W. N. BLAKEMAN, JR. U. S. 1,375,353, Apr. 19. A paint adapted for general use is formed of a soft and flowing hydrogenated linseed oil or similar hydrogenated oil, an anhydrous pigment such as ZnO , BaSO_4 , PbSO_4 , and other oils and driers.

Paint vehicle. W. N. BLAKEMAN, JR. U. S. 1,375,354, Apr. 19. A paint vehicle adapted for use with anhydrous pigments such as "zinc-lead" pigments is formed of tung oil, cottonseed oil, menhaden oil and a hydrogenated cottonseed or menhaden oil with a liquid drier. U. S. 1,375,355 relates to a paint prepd. with such a vehicle together with a suitable pigment.

Zinc sulfide. P. COMMENT. U. S. 1,374,435, Apr. 12. Anhydrous sulfide of Zn which is stable against atm. influences and suitable for use in paints is formed by calcining a mixt. comprizing a polysulfide of Zn other than the persulfide together with ZnSO_4 and Na_2SO_4 .

Automobile polish. P. A. RALLY. U. S. 1,376,228, Apr. 26. A polishing compn. adapted for use on automobiles and similar surfaces is formed of gum mastic 6 oz., C_{10}H_8 6 oz., alc. 1 gal. and a coloring material, e. g., lampblack 4 oz.

Phenol condensation products. B. B. GOLDSMITH. U. S. 1,375,959, Apr. 26. In effecting condensation reaction between phenolic substances and $(\text{CH}_3)_2\text{N}_4$ or other substances containing a reactive CH_2 group, the materials are heated in xylene, at temps. up to 165° , to obtain a product which is readily moldable. If a large amt. of xylene is used, the product seps. out as a pulverulent ppt. after the heating has progressed for some time. If an excess of phenol also is used, the temp. may be carried as high as 180° before the resinous product ppts. out.

27—FATS, FATTY OILS AND SOAPS

E. SCHERUBEL

Investigation of chrysalis oil. SOJIRO KAWASE, KEIJI SUDA AND AKIRA FUKUZAWA. *J. Chem. Soc. Japan* 24, 181-235(1921).—Chrysalis oils from 5 different species were analyzed. The av. findings are d_{15} 0.9253, n_{20} 1.464, Engler viscosity (20°) 8.14, Redwood viscosity (30°) 2 min. 15 seconds, flash point 201° , m. 11.8– 16° , solidifies 6.1° , heat of combustion 9508.76 g. cals., acid no. 7.97–71.76, sapon. no. 194.02, Wijs 132.90, Hehner no. 94.32, unsapon. matter 2.48%, hydroxy fatty acid 0.33–1.18%, acetyl acid no. 140.27, acetyl no. 3.46, glycerol 7.46–9.68%, R.-M. no. 0.585. The mixed oil gives about 25% solid acid and 75% of the liquid acid, the former being palmitic (m. $64\text{--}4^\circ$), and isopalmitic acid (m. $57\text{--}9^\circ$). The liquid acid consists of 80% oleic acid, 20% linolenic acid (contg. isolinolenic acid), and a trace of linolic acid. The free acid present in the oil is the same as that contained in the neutral oil. On bromination of the liquid acid hexabromo and dibromostearic acids are obtained. When linolenic and isolinolenic acids were brominated granular hexabromostearic acid (m. $177\text{--}80^\circ$), insol. in ether and petroleum ether, and oily heptabromostearic sol. in ether, but insol. in petroleum ether, are formed. S. T.

Cleavage-degree of fats. D. HOLDE. *Chem. Umschau* 28, 113-4(1921).—Referring to the 2 errors pointed out by Fahrion (C. A. 15, 1632) in Davidsohn's formula $x = (\text{Acid no.} \times 100) / \text{sapon. no.}$, H. suggests instead the use of the formula $x = (100 \times \text{Acid No.}) / \text{Neutr. No.}$, in which the Neutr. No. represents the acid no. of the total fatty acids in the cleaved fat, thus requiring 2 detns. instead of one. H. also calls attention to the fact that fatty anhydrides—when titrated with 0.1 N NaOH in the presence of much alc.—do form ethyl esters with half their mol. and a Na salt with the other half. These anhydrides may be sepd. by dil. Na_2CO_3 from the accompanying free acids in ether or gasoline soln. While such anhydrides are probably absent, it is

possible that di-acids, which would behave in a like manner, may be present, and H. suggests that the free acids may be removed by Na_2CO_3 from their ether or gasoline soln. and detd. gravimetrically and also a detn. of the unsapon. matter be made.

P. ESCHER

Catalytic reduction of fats by means of palladium. A. SKITA. Univ. of Freiburg. *Z. angew. Chem.* 33, Aufsatzteil, 72(1920).—This refers to F. F. Nord's article (*C. A.* 14, 853), which is based on his 1913 Dissertation, and contains some corrective sentences: When C. F. Böhringer and Söhne at Mannheim Waldhof carried the lab. expt. into an industrial scale they found that most fats could be converted into solid glyceryl esters by this method in 2-3 hrs. in any desired quantity. Normann's service to the industry of fat-hardening lies in the fact that he applied Sabatier's reduction method to liquid fats while exposing them to the action of H.

P. ESCHER

Examination and utilization of bone-fats. J. WOLFF. Lab. of S. H. and V. Ges. *Z. deut. Ol-Fett-Ind.* 41, 227-8(1921).—The presence of lime soaps in bone fats causes emulsions and poor yield in the cleavage process. For analytical purposes all bone-fats should first be boiled with HCl and washed. A special separatory funnel for boiling with its outlet at right angle to its inlet is described and illustrated (for corrected ill. see p. 276). Analyses of 3 bone fats which could not be completely salted out in the soap kettle are tabulated. The cause was found to lie in the presence of lime soaps; after they were decomposed by HCl and purified by $\text{Al}_2(\text{SO}_4)_3$ the trouble was removed.

P. ESCHER

Hydrolysis of fats by reagents from cymene. RALPH H. MCKEE AND LELAND J. LEWIS. *Chem. Met. Eng.* 24, 969-75(1921).—Cymenesulfonic acid is sol. in hydrocarbons and oils as well as in H_2O , it is an excellent emulsifying agent and it is easily and cheaply made; so that its applicability as a fat-hydrolyzing reagent has led the authors to demonstrate its use successfully. The compd. was made by adding 300 g. 66° B ϕ . H_2SO_4 gradually to a mixt. of 140 g. cymene and 280 g. of oleic acid, keeping the temp. below 35°. After 24 hrs., stirring 500 cc. distd. H_2O were added, the whole was boiled for 20 min. and then purified by washing with acidulated H_2O and gasoline. The av. % of S found was 6.6. In comparing the rates of hydrolysis of cottonseed oil by cymene-stearosulfonic acid and other reagents it was noted that the oil could be hydrolyzed with 1% of this reagent without the addition of acid and without resorting to H_2SO_4 treatment of the oil. No action takes place with 0.25% of reagent and 1% H_2SO_4 ; but with 0.5% reagent and 1% acid the hydrolysis was very rapid: 25% of the oil was hydrolyzed in 2 hrs., 67% in 3 hrs. and 87% in 5 hrs. Coconut oil is more readily hydrolyzed than cottonseed oil; 0.5% of reagent brings about hydrolysis without a previous H_2SO_4 treatment. The darkening of the fatty acids when the new cymene reagent was used was only about half as great as when commercial reagents were used. Coconut oil with a reading of 0.08 red on the Lovibond tintometer, had a reading of 0.8 red when 95% hydrolyzed with the cymene reagent and 1.6 and 2.4 red with Kontakt and Twitchell reagent, resp. In comparing the merits of the new reagent with others it is necessary to consider cost of materials and other expenses arising from their prepn. Cymene can be purchased and refined at less cost than benzene and naphthalene. Cymenestearosulfonic acid can be prepd. at a cost of about 10c., while the cost of prep. the other compds. would be somewhat higher. Six graphic charts are given showing comparison of speed of hydrolysis of fats and color changes of fatty acids.

E. SCHERUBEL

Colloidal clay and the hydrolysis of oils and fats. FRANK E. WESTON. *Chem. Age (London)* 4, 604-5, 638-41(1921).—The method of experimenting was as follows: a known wt. of oil in a conical flask was mixed with a known amt. of NaOH soln., a known amt. of clay added and the flask heated for known time on a steam bath. At

the end of the heating period the contents were dild. with a known amt. of H_2O and the excess $NaOH$ was titrated with NH_4SO_4 . The results indicated that colloidal clay has a marked effect and that within certain limits 20% of clay is required to obtain the optimum hydrolysis. This is shown in the case of coconut oil, where 7 g. of oil and 0.1 g. of clay in 1 hr. gave 54% hydrolysis and 7 g. of oil and 1.5 g. of clay in 1 hr. gave 99.2%. Parallel series of expts. were carried out under identical conditions except that $\frac{1}{2}$ of the flasks contained no colloidal clay. All the oils examd., 10 kinds, were more easily hydrolyzed in the presence of colloidal clay than without; those most easily hydrolyzed readily formed emulsions with the clay. On plotting curves showing the relation between the amt. of hydrolysis and the time taken it was found that after a certain amt. of hydrolysis had taken place the rate began to increase; this increase was synchronous with the formation of a more or less perfect emulsion. Expts. on emulsification were carried out as follows: into a flat-bottomed graduated tube known wts. of oil and clay and water were placed, the tube was closed and shaken in a machine and then allowed to stand for 24 hrs. The vols. of emulsion were then read off. In all cases emulsions of a permanent character were produced and it was found that there is a limiting value to the quantities of oil and water that produce permanent emulsions, and this limiting value is the same whether the water is added to the oil or *vice versa*. The increase in the rate of hydrolysis of oils in the presence of colloidal clay appears to be closely related to the degree of emulsification produced between the oil and the soln. of $NaOH$. The following claims are made for colloidal clay soap prepd. by incorporating the clay directly with the oil or fat and caustic during the sapon.: (1) It is more sol. in water and lathers more quickly. (2) It is ready for use sooner after manuf. and dries quickly, but does not become too dry by long keeping. (3) It is less likely to contain free alkali owing to the adsorptive power of colloidal clay. (4) It improves in quality on aging. From no point of view can it be maintained that colloidal clay plays only the part of a filler, whether it be the effect it has on the surface tension of soap solns., its adsorptive power and the part it plays in the formation of oil and water emulsions, or its effect on the hydrolysis of oils and fats.

E. SCHERUBEL

Tallows used for launching ships. J. J. KING-SALTER. *Inst. Naval Arch., Mar.* 18, 1921; *Engineering* 111, 405-7(1921).—Expts. carried out on 5 samples of tallow showed that the gradients of the temp.-hardness and temp.-compression curves were proportional to the titer tests (solidification point of insol. fatty acids). The samples examd. had the following titer values: mutton tallow with 15% of stearin, 48.6°; mutton tallow, 48.1°; beef tallow, 46.1°; beef tallow and "C" grade beef tallow, 48.25°; "C" grade beef tallow 42.2°. Hardness tests were carried out in a modified Brinell tester, in which a steel ball $\frac{1}{8}$ " in diam. was crushed into the surface of the tallow by the impact from a wt. of 0.25 lb. falling a distance of 6" on to a steel rod or piston in contact with the upper surface of the ball. Depth of sinkage was registered directly by a lever acting from a collar on the piston to a scale reading to 0.001" by means of a vernier. Both hardness (expressed in arbitrary units) and compression (in tons per sq. ft.) were found to be proportional at a number of temps. below the titer figure to the titer number, and the hardness test is recommended for ascertaining the suitability of tallows for launching purposes. The load-sustaining power and also the titer value of an unknown tallow can be conveniently detd. by interpolation from reference to curves correlating these figures on known samples. The load-sustaining power at different temps. may similarly be interpolated. Purified recovered tallow is unsatisfactory owing to its brittle and crumbly character. As a lubricant for use between the general ways and the sliding way, a mixt. of "Vaxel" (a lime-resin-oil soap softened with mineral oil) and soft soap proved the most efficacious in inhibiting amalgamation of the tallow surfaces. The effect of boiling a natural tallow for 4 hrs. was to increase the hardness, the hardness

factor falling from 101 units to 71 units (a hardness factor of zero on the scale corresponding to an actual hardness of infinity).

J. S. C. I.

Pressure oxidation of paraffin wax. F. FISCHER. *Ges. Abhandl. Kennl. Kohle* **4**, 35-47(1919).—The oxidation was conducted in a horizontal autoclave provided with an agitator, 200 g. of hard paraffin wax being heated to 170°, while a current of air at 30 atm. pressure (200 l. per hr.) was passed through. 800 cc. of 2.5 *N* Na₂CO₃ solu. was present, and oxidation was continued until 1/2 of this was neutralized by the fatty acids formed. The residue was not pure paraffin wax. Fatty acids of av. mol. wt. 250, insol. in water and suitable for soap making, were obtained. Acids sol. in water were also produced and a considerable quantity of CO₂. The Na salts of the higher acids suffer some decompn. during the reaction. Some light paraffin oils were obtained.

J. S. C. I.

Influence of various factors during the pressure oxidation of paraffin wax. F. FISCHER AND W. SCHNEIDER. *Ges. Abhandl. Kennl. Kohle* **4**, 48-93(1919).—The influence of various factors was ascertained by variation of the conditions of the normal expt. described in the preceding abstract. The degree of filling of the autoclave was important. Rise of temp. affected the color of the products as well as the speed of oxidation. Quantity of air influenced the mol. wt. of the acids. Increase of air pressure caused acceleration of the reaction. Undue prolongation of the oxidation caused a secondary decompn. of the acids produced. Speed of stirring, quantity and concn. of alkali had little influence. The use of lime as base was found undesirable. The quantity of paraffin influenced the color and yield of acids. Fe, Mn, and Cu were the best catalysts, but Ce, Ti, fuller's earth, and charcoal gave products with the best color. The addition of toluene and xylene improved the yield of solid fatty acids, although neither of these solvents, in the absence of paraffins, is oxidized under the exptl. conditions. When the app. was lined with glass or Pb the reaction was retarded and the color of the product improved. Paraffins obtained from lignite, coal, peat, or mineral oil are all suitable for pressure oxidation, although the first two are more resistant. Paraffin oils yielded liquid acids insol. in water. In the absence of alkalis paraffin wax was more extensively oxidized than in their presence. The yield of fatty acids was 74% of the paraffin consumed, but their color was dark brown.

J. S. C. I.

By-products of the pressure oxidation of paraffin wax. W. SCHNEIDER. *Ges. Abhandl. Kennl. Kohle* **4**, 101-17(1919); cf. *C. A.* **15**, 143.—In the treatment of the product obtained in oxidation expts. such as described in the 2 preceding abstracts, the cake of unchanged paraffin was sepd. and the residue worked up to a solid soap. The presence of water-sol. salts of lower fatty acids in the crude product would, if these were not removed, render the soap hygroscopic and impart a disagreeable odor. The soln. of salts of lower acids, however, lathers well, and such solns. are suitable for the laundry and scouring purposes. The soda soln. of these acids was filtered off from the insol. salts and evapd. to dryness. The residue contained 1% of neutral material sol. in benzene, and 54% of fatty acid salts, equiv. to 46% of fatty acids. Half were insol. in water, ranging from capric to lauric acids, the rest of the acids being sol. Some oils sepd. on cooling the compressed air after leaving the autoclave. None boiled below 150°, and 67% between 150° and 250°. Neutral substances contg. O, e. g., alcs., aldehydes and ketones, were present. Solid substances, of similar chem. character, also contg. O, were found in the cake of residual unoxidized paraffin. The liquid portions had a fruity smell, while the solid portion resembled a true wax rather than paraffin.

J. S. C. I.

Treatment of the acids obtained in the pressure oxidation of paraffin wax. W. SCHNEIDER AND O. JANTSCH. *Ges. Abhandl. Kennl. Kohle* **4**, 118-30(1919).—The oxidation products of paraffin obtained as described in the preceding abstracts were

examd. with a view to identifying the acids. To effect a sepn. the ethyl esters were prepd. The acids conformed to the general formula $C_nH_nO_2$, but the presence of hydroxy, keto, and dibasic acids could not be established. For the acids identified the values of n were 19, 17, 15, and 13, the odd numbers of C atoms being predominant. On the other hand, in fats and oils the acids have mainly an even number of C atoms.

J. S. C. I.

Oxidation of paraffin wax by air at ordinary pressure. W. SCHNEIDER. *Ges. Abhandl. Kennt. Kohle* 4, 132-42(1919); cf. *C. A.* 15, 743.—Expts. on the oxidation of paraffin wax were made in glass and Fe vessels. The yield of fatty acids insol. in water was only 2-3% in glass vessels, but 64% in Fe. HgO had no catalytic effect. The formation of acid anhydrides is indicated by the presence of products sol. in hot NaOH soln., but insol. in Na carbonate. The reaction velocity is very much smaller than when pressure is employed.

J. S. C. I.

After-treatment of solution obtained in pressure oxidation of paraffin wax. F. FISCHER AND W. SCHNEIDER. *Ges. Abhandl. Kennt. Kohle* 4, 94-100(1919); cf. *C. A.* 14, 3249.—When prepg. soaps by the pressure oxidation of paraffin wax (cf. Schneider, preceding abstract) the soda soln. employed should be neutralized as completely as possible. The soaps can be sepd. by direct evapn. of the soln., or, better, by removing the supernatant layer of paraffin and allowing to stand overnight, when the salts of the fatty acids sep. in the solid state. Brown soaps may be bleached by NaClO or by further treatment in the autoclave at 160°. Still more effective is treatment of the warm soln. with acid or with CO under pressure at 180-200°. The CO, behaving as formic anhydride, liberates free fatty acids with the production of Na formate. This may be converted into formic or oxalic acid or calcined to regenerate the Na_2CO_3 originally used. The fatty acids pptd. may be purified by distn. either with superheated steam or *in vacuo*. Neutral substances remaining are removed by distn. under diminished pressure at 250°, followed by extn. with benzene in the cold. In the prepn. potash or mixts. of potash and soda may replace Na_2CO_3 to give correspondingly different types of soap. All the soaps lather well.

J. S. C. I.

Pressure oxidation of montan wax. F. FISCHER AND W. SCHNEIDER. *Ges. Abhandl. Kennt. Kohle* 4, 180-200(1919); cf. Fischer and Tropsch, *C. A.* 14, 1427.—Pressure oxidation expts. with air made on crude montan wax, with and without preliminary sapon., indicated that a degradation to medium and lower fatty acids occurred, although montan wax is distinctly more inert in this respect than paraffin wax. The soaps obtained from the reaction products did not lather so well as those derived from paraffin. The yield was also lower. Fatty acids once formed are rapidly broken down, thus accentuating the poor yield.

J. S. C. I.

An investigation of the fats of the gonads of *Rhizostoma cuvieri*. FELIX HAUROWITZ. *Z. physiol. Chem.* 112, 28-37(1920).—The gonads were dehydrated with $(NH_4)_2SO_4$ and extd. with 96% alc. and with ether. On removing the solvent the fat was obtained which formed about 9.4% by wt. of the original material. The fat gave the following figures: d. 0.9606; acid number, 52.2; sapon. number, 190.7; Hehner's number, 83.7; I number, 110.4; R.-M. number, 2.6; neutralizing number for the water-sol. acids of 5 g., 60.0. The fat contained 0.542% of N, 0.335% of P, and 2.87% of Cl. Br, I, and S were absent; the unsaponifiable portion was 2.9% of the total fat. Hydrocarbons were absent. The presence of cholesterol and cetyl alc. was established. Among the fatty acids formic, *n*-octoic, myristic, palmitic, and linolic were identified; oleic and hydroxy fatty acids were absent. In the unsaponifiable portion, choline, NMe₃, and phosphoric acid in the free condition, as well as in combination with org. compds., were found.

J. C. S.

Cactus (*Opuntia*) of Sardinia. E. PUXEDDU AND A. MARINI. *Giorn. chim. ind.*

applicata 3, 95-7(1921).—This plant is very abundant in Sardinia. The authors obtained the following data in respect to it. The juice contained 12.12-12.45% sugar. The fruit weighed 54.2% and the rind 45.8%. The rind contained 1.40% sugar. The seeds were small, whitish, roundish and very hard, and amounted in wt. to 4.60% of the wt. of the fruit. On grinding they gave an unctuous brown powder that could be extd. with CHCl_3 , petroleum ether, benzene, and CCl_4 . The oil extd. had an intense yellow to reddish yellow color. CCl_4 gave the highest yield, i.e., 7.98%, while petroleum ether gave only 6.58%. The residue in the Soxhlet was a clear yellow powder containing Fe, Mg and K. The oil becomes thick on exposure to the air for a long time. The oil gave the following consts.: index of refraction = 1.475-1.476; $d_{40}^{20} = 0.9179$; index of acidity = 4.985 (2.514 as oleic acid, 0.356 as SO_3); sapon. number = 160.50; I number = 103.06; Ac number = 41.6; Hehner number = 95-96.5. The liquid fatty acids sepd. from the oil constituted a limpid yellow liquid, while the solid fatty acids formed a white cryst. mass, m. 52° , which gave on treatment with alc. 3 fractions m. resp. at 54, 55 and 56° .

ROBERT S. POSMONTIER

Glycerol manufacture. VII. Purification of glycerol lyes, sweet water and fermentation water. P. VERBEEK. *Seifensieder-Ztg.* 48, 163-5, 202-4, 244-6, 287-90, 331-4, 376-8, 423-6, 474-5(1921); cf. C. A. 15, 2203.—Under the present economic conditions in Germany the purification of the very impure glycerol lyes has become the most important step in glycerol making. Its manuf. by sugar fermentation had to be stopped because of high sugar prices. The methods now described have been developed for very impure lyes. A. Sapon. lye. (a) Gerber-Verbeek method: The lye is agitated at $60-70^\circ$ with $55-60^\circ$ Bé. H_2SO_4 until almost neutral and is heated to 90° to drive off CO_2 . A 40% soln. of $\text{Al}_2(\text{SO}_4)_3$ (15%) is added with thorough agitation and boiled until a filtered test sample to which a few drops of $\text{Al}_2(\text{SO}_4)_3$ have been added remains clear. The lye has now an acid reaction and is filter-pressed in wooden presses. (Filtrate I.) Any glue substances that may have been present are not removed by this treatment; tannic acid, which would ppt. them, is too expensive and it is difficult to gage the amt. required. If filtration is too slow, 3-6 kg. "hydrosilicate" are added before filtering. Filtrate I is boiled in a vat contg. nearly enough NaOH for neutralization and 40° Bé. NaOH is added until a clear filtrate results. It is filter-pressed without pressure, on account of the slimy character of $\text{Al}(\text{OH})_3$. The filtrate is neutralized to 0.01% NaOH excess. Details of material required per charge are given. (b) Gerber method: $\text{Al}_2(\text{SO}_4)_3$ was unobtainable at one stage of the war and FeCl_3 was substituted as follows: the lye is nearly neutralized as in a, but HCl is taken in place of H_2SO_4 and a 50% soln. of $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ in place of $\text{Al}_2(\text{SO}_4)_3$, otherwise the treatment is exactly the same as in a and the final filtrate must contain 0.01% NaOH excess. A disadvantage of this method is the necessity of wooden presses, and the iron- or lead-lined vats are considerably attacked by hot solns. This method has demonstrated that war-time lyes—and perhaps all lyes—contained reducing substances, since much of the FeCl_3 was reduced to the greenish ferro-compds., thereby making the purification more perfect than with $\text{Al}_2(\text{SO}_4)_3$, which has no such oxidizing power. (c) Verbeek's method. This method has been worked out only in the lab. it is more expensive, requiring more app. and labor. The lye is acidified with enough excess of H_2SO_4 to decompose all soaps. It is boiled with an excess of 18° Bé. milk of lime, which removes some fatty acids and ppts. Fe. It is filter-pressed and the boiling-hot filtrate is nearly neutralized with H_2SO_4 as in a and treated with an excess of $\text{Al}_2(\text{SO}_4)_3$, which removes the remaining fatty acids. It is filter-pressed and the hot filtrate treated with Na_2CO_3 (9-18% soln.) until a filtered test-sample remains perfectly clear on further addition of Na_2CO_3 ; this removes all Al, Fe and Ca. The liquor is again filter-pressed, the hot filtrate acidified and then treated with NaOH to 0.01% excess. B. Glycerol-water.

(a) Gerber's modified method for waters free from lime. These waters may be neutral or acid in reaction. In the latter case they are boiled with an excess of a suspension of pptd. BaCO_3 in condensate H_2O with vigorous agitation until neutral to methyl orange and allowed to settle. The supernatant neutral soln. is treated with $\text{Al}_2(\text{SO}_4)_3$ as previously described, producing an acid reaction; this is removed by an immediate second boiling with BaCO_3 until blue litmus is no longer reddened. The liquor is filter-pressed and the filtrate treated hot with $\text{Ba}(\text{OH})_2$ to distinct alkalinity, and while it is boiling, $(\text{NH}_4)_2\text{SO}_4$ is added until a test sample remains clear on further addition of $(\text{NH}_4)_2\text{SO}_4$. The NH_3 is driven off by boiling and the liquor is finally filter-pressed. Glycerol waters contg. lime are treated as above when neutral or acid in reaction, but when alkaline they are first neutralized by H_2SO_4 and the boiling with BaCO_3 must be prolonged to insure pptn. of all CaSO_4 . The addition of $(\text{NH}_4)_2\text{SO}_4$ or $(\text{NH}_4)_2\text{C}_2\text{O}_4$ increases the ash content of the product, but in its analytical detn. the temp. is always high enough to volatilize all NH_4 salts; for this reason a sep. detn. of NH_3 is always advised.

(b) Gerber's modified ZnSO_4 method. During the war the unobtainable $\text{Al}_2(\text{SO}_4)_3$ was replaced by ZnSO_4 (free from Fe, Cl, and alkalis), which works well with alkaline waters; acid waters must first be made alkaline by $\text{Ba}(\text{OH})_2$; the remaining operations are the same as in a. C. Fermentation liquors. Gerber's method: The fermentation liquors contain Mn, used as a catalyzer. The acid liquor is first boiled with BaCO_3 and then treated with $\text{Ba}(\text{OH})_2$ until no more ppt. forms. The liquor is filter-pressed, the alkaline filtrate treated with $\text{Al}_2(\text{SO}_4)_3$ and again neutralized with BaCO_3 and filter-pressed. The filtrate is treated again with $\text{Ba}(\text{OH})_2$, then with $(\text{NH}_4)_2\text{SO}_4$ and finally pressed, requiring 3 pressings in all. A detailed description with plans of a complete purifying installation gives much information about the required app. and handling of liquors, prepn. of solns., etc.

P. ESCHER

Turkey-red oils. VERBAND DEUTSCHER TÜRKISCH-ROTHÖLFABRIKANTEN E. V. *Chem. Umschau* 28, 115-6(1921).—The sulfonate content may vary between 72 and 76% fatty acid hydrates, with an av. of 75%. A 50% product of "trade-custom" is defined as one in which 50 lbs. of sulfonated and washed castor oil is used for every 100 lbs. finished product, and contg. 36-38% fatty hydrates. Standard volumetric and gravimetric methods are prescribed for the detn. of fatty acids, to which the editor of *Chem. Umschau* (W. Fahrion) remarks that the above agreement appears to be one-sided since the consumer has not been heard; F. also considers Herbig's gravimetric method superior to the proposed wax-cake method.

P. ESCHER

Partial salting out of soap mixtures. J. WOLFF. Lab. of the S. H. and V. Ges. *Z. deut. Öl-Fett-Ind.* 41, 289-90(1921).—A soap charge of 39% animal fatty acids and 61% of a mixt. of $\frac{1}{4}$ palm-kernel-oil acids with $\frac{1}{4}$ coconut-oil acids yielded a normal settled soap but a lye which congealed on cooling. The fatty acids from the settled soap had a sapon. no. of 222.6, while the soap recovered from the lye showed 236.9 and the acids from the final lye 239.6 and those from another soap kettle 251.4. These values indicate a selective sepn. of the acids during the salting out process, aided by the high content of caustic (1.8%) and carbonate (1.6%) of the lye.

P. ESCHER

Microanalytical methods in oil analysis. AUGUSTUS H. GILL AND HENRY S. SIMMS. *J. Ind. Eng. Chem.* 13, 547-52(1921).—Very close analytical results on the sapon. no. and I. no. of oils are obtainable with 15 and 11 mg., resp., or about 1/100 and 1/30 the usual quantities. Good results can be obtained for sp. gr. with 1-g. samples. The app. is that ordinarily found in the lab. or easily made by a good manipulator.

E. S.

Determination of refractive indices of oils. HENRY S. SIMMS. *J. Ind. Eng. Chem.* 13, 546-7(1921).—The method described in this paper is based upon the optical effects produced when light passes through portions of the substance having curved surfaces and calls for the use of the microscope. If a spherical bulb of oil is immersed in a medium

of another oil it will magnify or reduce depending on whether it has a greater or smaller n_D than the medium. If it has the same n_D there will be no effect. The value of n_D is given by $n = 1 + (d/4f)$ where d = diam. of bulb and f = focal length. For an unknown oil in the bulb n_D may be obtained by comparing it with a series of known oils contained in test-tubes.

E. SCHERUBEL

Direct identification of soy-bean oil. R. D. BONNEY AND W. F. WHITSCARVER. *J. Ind. Eng. Chem.* 13, 574(1921); cf. *C. A.* 15, 444.—The test of C. A. Newhall, which depends on the formation of a lemon-yellow emulsion when a CHCl_3 soln. of the oil is shaken with a soln. of uranium nitrate and a little gum arabic is neither characteristic of soy-bean oil nor sensitive enough to be of practical value. Linseed oil gives the same color.

E. SCHERUBEL

Direct identification of soy-bean oil. CHARLES A. NEWHALL. *J. Ind. Eng. Chem.* 13, 574(1921).—Linseed oil gives a distinctly browner shade of yellow than does soy-bean oil. The test must be used with caution.

E. SCHERUBEL

Treatment of oil-bearing products. ANON. *Chem. Age* (London) 4, 614-15(1921).—A description of the solvent extrn. process as carried out by the Standar Chem. Eng. Co. plant of Panton Street, London. This plant consists of a large cylindrical tank, a rectangular tank and a small cylinder. A diaphragm plate divides the former, which is provided with two false sides, into 2 portions, an extractor and a distiller. The rectangular tank also is divided into 2 compartments, which form the condenser and the solvent reservoir. The small cylinder is an automatic separator and deals with condensed solvent vapors and steam. The raw material is charged into the extractor through a door and rests on a double set of perforated plates, between which are filter cloths. A conical valve distributes the material over the extractor surface. In downward extrn. the door is closed after charging and the solvent which may be benzine, benzene, or trichloroethylene is admitted through the solvent pipe and the sparge ring. Passing from the sparge ring the solvent is heated by a twin steam coil, which is so arranged that all the solvent entering through the sparge ring must flow over it. The material is covered by the solvent and is simultaneously being heated by the closed steam coils. When the oil is dissolved the soln. is run off into the distiller through valves and a syphon. In upward extrn. the solvent is admitted into the vessel under and through the bottom perforated plates and is heated by closed steam coils and passes upwards through the material. After dissolving the oil it passes through the top double set of perforated plates and flows over the false sides into the distiller. The solvent is vaporized from the oil in the distiller by closed steam coils and passes into the condenser and from here into the automatic separator, where the condensed steam is sepd. from the solvent. The "Standar" plant was originally based on the "Merz" principle, in which the solvent is sprayed over the material. It was found, however, that an extrn. proceeding in one direction only lost in efficiency owing to the tendency of the material to form pockets, with the result that insufficient resistance was offered to the formation of passages by the solvent during its action. The upward and downward method as used in this process ensures a frequent change in direction in extrn. so that the material is dislocated by every change. E. SCHERUBEL

Distinguishing expeller-process cottonseed oil from hydraulic-process oil. R. H. FASH. *Cotton Oil Press* 4, No. 12, 46(1921).—The emulsion of oil and NaCl soln. used in detg. the free fatty acids with crude expeller-pressed cottonseed oil is a deeper yellow color than that of hydraulic-pressed oils.

H. S. BAILEY

Relative quality of expressed and solvent-extracted cottonseed oil. J. H. SHRADER. *Cotton Oil Press* 4, No. 12, 42-5(1921).—Studies of the relative value of expression and extrn. processes for obtaining oils have seldom considered the quality of the oils obtained. Since this is of great importance an investigation was undertaken on (1) the quality of

extd. cottonseed oil prepd. from the meats as now delivered to the press room and (2) changes from present mill procedure necessary to give by solvent extn. finished products of acceptable grade. Three samples of oil from the same batch of cottonseed were obtained, (1) from a regular hydraulic press, (2) by extn. in glass with C_6H_6 , and (3) by similar extn. in contact with rusty iron. Each of these oils was refined by the official A.O.C. S. and special methods. The results indicate that the present commercial method of refining is not applicable without modification to C_6H_6 -extd. oil. The oil extd. in the presence of iron exhibits color effects more difficult to remove than oil extd. and freed of solvent wholly in glass. Both extd. oils were inferior to the regular pressed oil. Further expts. in which pressed oil was dissolved in C_6H_6 and then treated exactly as had been the solvent oils proved that its quality was not affected by such treatments even in the presence of iron. It would seem, therefore, that C_6H_6 exts. from cottonseed something not present in pressed oil, which attacks iron. Samples of extd. and pressed oils were refined by the official method and also in soln. in C_6H_6 , with the result that lighter-colored products were obtained when the extd. oils were refined in the solvent than when the solvent was first removed. On pressed oils there was no advantage in refining in C_6H_6 . Extns. of cottonseed hulls from fresh and rancid seed and mixts. of hulls and meats proved pretty conclusively that the effective sepn. of hulls so removes the main cause of color that the finished oil is of a color grade comparable to that of expressed oil.

H. S. BAILEY

Norwegian herring oils. THOR LEXOW. Lab. Melbo. *Chem. Umschau* 28, 85-6, 110-3(1921).—The best herring oil is produced in Northern Norway from fresh herrings and after hydrogenation is used for food purposes. The Southern Norwegian factories work with pickled herrings almost exclusively and their inferior oil is used in tanneries and for hardening steel. As by-products there are obtained press-cakes contg. 70% protein, which are an excellent fodder. Herring oil varies in color from light yellow to brown-black; it thickens at 8°, sepg. considerable stearin. It contains the satd. acids of C_{14} to C_{18} and the unsatd. oleic and clupanodonic C_{18} , gadoleic C_{20} and erucic acid C_{22} , also hydroxy acids and unsapon. matter. Oil from salted herrings contains in addition some lactones, lipoids and soaps. The data that follow are based on some 400-500 analyses made in recent years of oils from the usual fishing grounds, extending from the Northern Finmarkfjords to Southern Helgeland. (1) *Free fatty acids.*—The lipase enzyme begins to split the oil immediately after death of the fish, reaching its greatest velocity during the first week and slowing down later. Temp. has the greatest influence upon its speed, the limits being -10° and $+40^\circ$ with an optimum at 25° . The changes during storage of the herring resemble those occurring during pickling and are essentially a slow cleavage process; the presence of NaCl in pickled herring modifies it by absorbing H_2O and retarding the velocity. Oils vary in free acid from 1.2 to 46.3, normal oils from fresh material between 2.0 and 5.0%. Color is independent of free acids and is due to variation in food and the presence of NaCl. (2) *Sapon. No.*: Oils of less than 5% free acids vary between 183 and 190. Neither season nor size of the fish influences the sapon. no., but increasing latitude raises it; there seems to be a connection between sapon. no. and unsapon. matter. (3) *Unsapon. matter.*—The unsapon. matter is a cryst. substance of pleasant odor and varies in color from light yellow to dark brown. The highest value found by L. in pure herring oil is 2.43%. A table which represents 18 samples of oil is given, varying between 0.73 and 2.04%. (4) *I no.*—About 120 herring oils with less than 5% free acid had I nos. (Wij's) of 108.5-155.1. The highest value found by L. was in a dark red August 1919 oil from Iceland with the following const's. sapon. no. 187.2, acid no. 6.15, I no. (Wij's) 161.1, unsapon. matter 1.93%, insol. bromides of the fatty acids (Bull) 29.35%. The principal factor which influences the I value is the season of the year, which det's the ocean temp.

and this in turn the food available. All high I values occur in July in oils of a red color, the color coming from a species of minute red crabs (*Calanus finmarchiensis*) which frequently is numerous enough to give the water a reddish tint. L. summarizes the results of his investigations by stating that the const. of herring oil depend on the amt. and character of the food taken by the fish and upon the process of digestion. The article is illustrated by tables and curves.

P. ESCHER

The utilization of "Sump" (*Balanites aegyptiaca*). PAUL AMMANN. *L'Agronomie Coloniale, Bull. mensuel du Jardin Colonial*. New Ser. 4, No. 16, 42-5(1919); *Bull. Agr. Intelligence* 11, 45-6.—The fruit of this small tree, which grows in semi-arid tropical North Africa and in India and Burma, resembles the date somewhat. It is eaten by the natives, and could be used as a source of alc. The kernel is rich in oil, but it is rather small and hard to sep. from the stone. No large-scale com. use of the tree seems likely.

T. G. PHILLIPS

Studies on the African "da" hemp (HEIM, et. al.) 23. By-products of forest industries (GROUD) 22.

CALMELS, G.: *Manuel pratique du Savonnier*. After E. Wiltner. Paris: Gauthier-Villars et Cie. 204 pp. F 7.50. For review see *Rev. prod. chim.* 24, 368(1921).

JUMELLE, H.: *Les huiles végétales*. Paris: J. B. Baillière. 493 pp. For review see *Bull. sci. pharmacol.* 28, 344(1921).

Catalysts for hydrogenation or reduction. A. RADISSON and P. BERTHON. U. S. 1,377,158, May 3. "Oxide of pptd. Ni," pure and dry, is suspended in melted paraffin and sufficient stearic acid added to give an acidity not in excess of 0.3% of the total wt. of the mixt. The mixt. is kept at a temp. of about 250° and H is passed through it. After 2.5-3 hrs. the Ni is reduced to a black metallic powder which is dried and formed into cakes contg. about 90% metal and 10% Ni oxide or suboxide. This product may be preserved indefinitely for use as a catalyst.

Dehydrogenating fatty substances. H. A. LEVEY. U. S. 1,374,589, Apr. 12. Cottonseed oil is treated with H under atm. pressure in the presence of Ni on kieselguhr as a catalyst, at a temp. of about 250° or slightly lower and after 10-14 hrs. the I No. is increased about 8%. If N or CO₂ is used instead of H, a somewhat greater change is produced in the I No. With CO at a temp. of 255° a still greater change in the I No. is attained, which may amount to 20%. A drying oil may be formed by first hydrogenating perilla oil until the I No. is reduced from about 190 to about 90 and then dehydrogenating to an I No. of about 140. A product of better drying properties is thus obtained than with a mere partial hydrogenation, indicating that the second phase of the process is not a mere reversal of the first phase. Other catalysts may be used, Pd and Ni appearing to be the best both for hydrogenating and dehydrogenating. Cu is better for the dehydrogenation than for hydrogenation. Various seed, animal or fish oils may be treated by this process to obtain a drying oil somewhat similar in characteristics to linseed oil.

Clarifying and decolorizing oils. R. W. MUMFORD. U. S. 1,377,021, May 3. Decolorization and clarification of oils such as cottonseed or mineral oil is effected by agitation of the oil, at a temp. of about 100° with carbonized peat or sawdust or a similar open-textured vegetable carbon having pores representing approx. the cellular structure of the vegetable material from which the carbon was made.

Sulfonating oils. F. L. RANDEL. U. S. 1,374,607, Apr. 12. Sulfonation of castor oil or other oils or fatty materials is effected with H₂SO₄ *in vacuo*, in order to prevent

the temp. from rising unduly. A volatile hydrocarbon, e. g., C_6H_6 , may be added for its evaporative cooling effect.

Copra-cooker. A. BARRA. U. S. 1,374,873, Apr. 12. The material under treatment is passed through horizontal cooking tubes extending through a steam chamber.

28—SUGAR, STARCH AND GUMS

F. W. ZERBAN

A contribution to the chemistry of the clarification of cane juice and of sugar manufacture. MİGAKU ISHIDA. Sugar Expt. Station, Formosa, Japan, *Bull.* No. 1; *Intern. Sugar J.* 23, 282-3(1921).—The degree of maturity of sugar cane may be found by detg. the *maturity coefficient*, which equals % sucrose / % reducing sugars. This coeff. is low during the growing stage, but rises sharply as soon as the cane begins to mature. The coeff. is characteristic for each variety and changes little from yr. to yr., provided the cane is planted at the same time, and cultural treatment is the same. After the cane begins to mature, the maturity coeff. fluctuates inversely with the temp. There is a distinct relationship between the K_2O and the sucrose content of the cane; the time at which rapid sucrose formation begins coincides with the period of max. K_2O content. The P_2O_5 in the cane shows very little change during the entire life of the cane plant. For the clarification of cane juice, a combination of $Mg(OAc)_2$ and NH_3 may be used with success. These reagents render amino acids and their amides optically inactive; they remove a large proportion of caramel; sucrose is not affected; dextrose and fructose, at the dilns. in which they occur in cane juice, are not attacked appreciably. The reagents may be used in the analysis of raw sugars and of cane juice, 15 cc. of 1.82% $Mg(OAc)_2$ soln. and 5 cc. of 18% NH_3 being added to 13 g. of raw sugar in 100 cc., and 10 cc. $Mg(OAc)_2$ soln. plus 5 cc. NH_3 to 50 cc. of juice in 100 cc. The same results were obtained as after clarification with Pb subacetate. The reagents cannot be used in the refining of raw sugar, because too large quantities would be required. However, good results were obtained in the clarification of cane juice. 0.25 to 0.3 cc. of $Mg(OAc)_2$ soln. plus 0.13 to 0.17 cc. NH_3 per 100 cc. of juice produced an av. rise in purity of 2.2 points. It is best to add the NH_3 first of the two reagents. The juice should be preheated to 80-100° and then cooled somewhat before addition of the NH_3 . Juices from most of the cane varieties tested were successfully clarified by the process. In the two exceptions, juices from cane grown on acid soils and, therefore, high in acidity, the difficulty was corrected by using more NH_3 . In order to get a still better clarification than with $Mg(OAc)_2$ and NH_3 alone, the juice is decanted after treatment with these reagents, and $Ca(OH)_2$ added. This causes a further increase in purity of 1.5 to 5 points. 25% of the N, 80% of the gums, and 30% of the ash are removed, particularly SiO_2 and P_2O_5 . The process has proved satisfactory on a commercial scale. All that is needed to install the process in an existing factory is the addition of a few settling tanks, and of the apparatus for producing NH_3 from $(NH_4)_2SO_4$ and lime, and $Mg(OAc)_2$ from $MgCO_3$ and $AcOH$. The sugar obtained is better than that made by sulfitation, and nearly as good as that produced by double carbonatation. The yield is at least equal to that obtained in other white sugar processes, while the expenses are less, about one third of those required in the ordinary carbonatation process. F. W. ZERBAN

The chemical composition of the beets during the campaign of 1919-1920. VL. ŠKOLA. *Listy Cukrovár.* 39, 121-4(1921); *Z. Zuckerind. Echoslov. Rep.* 45, 137-40(1921).

—The difference between the direct polarization of the pressed juices and their sugar content, detd. according to Clerget, did not exceed 0.28. For juices obtained by hot digestion the max. difference was 0.27. The amt. of dextrorotatory non-sugars in-

creased with the degree of decompn. of the beets. These, in juices from normal beets, were never greater than 0.25-0.28%. If the beets showed evidences of microbial decompn. this figure was higher. By the microbial decompn. dextrorotatory substances seemed to be formed, which on hydrolysis did not yield a noticeable amt. of levorotatory compds. These decompn. products, therefore, either remained unaffected by the conditions of the hydrolysis, or decomposed into simpler dextrorotatory compds. This view was confirmed by expt. Dextran was considered to be a constituent of the decompn. product and since it is only partly pptd. during the clarification with $\text{Pb}(\text{OAc})_2$, the difference between the sugar content (Clerget) and the direct polarization could be ascribed to its presence. The amt. of invert sugar increased with the degree of decompn. Total N varied between 0.142 and 0.280%. Expts. indicated that a part of the harmful N was changed by microbial action into albumin N. The betaine content of normal beets was 14-15%. The data did not indicate any decompn. of betaine by microbial action. The amt. of marc increased with the degree of decompn. of the beet. In normal beets the content varied between 5.4 and 5.75%; in diseased beets (juice purity = 78.6%) this increased to 7.76%, which is in accord with the decreased amt. of dry substance. This could be explained by supposing that the aqueous portion of the beet was partially gasified by the microbial action.

JOHN M. KRNO

Sugar beet growing experiments in Oran (Algeria). P. VERMIL. *Rev. Afrique Nord* 17, 304-10(1919); *Bull. Agr. Intelligence* 11, 201-3.—A large part of the local demand for sugar could be met by growing beets in the rather restricted suitable areas. A somewhat higher yield of sugar per acre can be obtained than in France. T. G. P.

The "Uba" variety of sugar cane in British South Africa. ANON. *Tropical Life* 15, 154-5(1919); *Bull. Agr. Intelligence* 11, 330-1.—This variety, whose source is unknown, is well adapted to the climate of Natal, and especially Zululand. The juice is of high quality, averaging 18.61% sucrose.

T. G. PHILLIPS

Influence of bagacillo upon the quality of the raw sugar made in Hawaii. R. C. PITCAIRN. *Intern. Sugar J.* 23, 289(1921).—The ash content of raw sugars made from juices which are obtained by modern heavy milling with thorough disintegration of the fiber is not any higher than that of sugars from juices extd. by less efficient mills. The bagacillo does, in fact, not interfere with the production of a good sugar. The high ash content of some Hawaiian sugars is due rather (1) to the high ash occurring in certain varieties of cane; (2) to excessive quantities of molasses left adhering to the crystal by uneven application of the wash water; (3) to the present systems of boiling low-grade products. The remelt used is often of too low a purity. Better results may be obtained by repurging the remelt in a sep. installation, and boiling the molasses resulting therefrom separately. The size of grain of low-grade sugars should be about 0.4 mm., larger grain causing incomplete exhaustion, and a smaller one interfering with proper purging. The grain should be made as even as possible. White sugar dust, at the rate of 1 lb. per 1000 cu. ft., is being used successfully for seeding the low-grade pans.

F. W. ZERBAN

Maize sugar. P. VIEILLARD. *Bull. Agr. Inst. Sci. de Saigon* 2, 106(1920); *J. Inst. Brewing* 27, 126(1921).—The stem of the maize plant normally contains no sucrose and very little dextrose, but if the ears are removed when the grain begins to be milky, sugars accumulate in the stem. In a series of expts. the stems were investigated at various periods (7-34 days) after removal of the ears. The stems freed from leaves yielded 36-48% of juice, as compared with 80% in the case of the sugar cane, but the "bagasse" contained much sugar extractable by suitable means. The total extractable sugar in the stems amounted to 7-10% of sucrose and 1-3% of dextrose. Owing to the large proportion of dextrose and non-sugars not more than $\frac{1}{10}$ of the sucrose present can be obtained cryst., but for the production of alc. this is immaterial. It is called.

that 130 gals. of alc. (abs.) could be produced per acre of maize crop, and the period between the sowing of the maize and the gathering of the stems would be about 100 days.

J. S. C. I.

The microchemical determination of nitrogen according to Kjeldahl. VL. STANĚK. *Listy Cukrovar.* 39, 221-4, 229-32, 237-9 (1921).—For detg. small amts. of N in sugar-house products, a modification of Pregl's microchem. method was developed. In the analysis of nitrogenous non-sugars, 10-20 mg. of the sample were found to be sufficient. The procedure followed was similar to the ordinary Kjeldahl method except that smaller amts. of reagents were used. Samples contg. betaine were found to be very resistant to the action of the H_2SO_4 . The decompn. in such cases was found to be aided by the presence of a small amt. of sugar. The titer of the $1/10$ N acid, used for absorbing the NH_3 liberated during the distn., was detd. against pure recrystd. NH_4Cl under the same conditions that existed during the actual analysis. The error in the detn. of N by this method was found to be equiv. to 0.5% on a 100% N basis. These results were obtained on pure aspartic acid. In detg. the N content of heavy sugar juices the maximum variation in the results was found to be 0.004% N. JOHN M. KRNO

The precipitation of amino acids into the sludge during the saturation of the lime with carbon and sulfur dioxides. VL. STANĚK. *Listy Cukrovar.* 39, 257-9, 269-70 (1921).—Aspartic and glutamic acids are pptd. into the sludge under conditions existing during the first satn.; 1.8% of CaO is used at a temp. of 85° and the satn. proceeds practically to neutrality (Siegfried and Schütte, *C. A.* 7, 1032). The amt. of leucine pptd. is insignificant. The aspartic acid is pptd. much more completely than asparagine. The same is true of glutamic acid. This indicates that a greater quantity of amino acids is pptd. into the sludge during the satn. and a better defecation of the juice is obtained, the more extensive the decompn. of the asparagine and glutamine during the defecation and satn. into NH_3 and the corresponding amino acids. This is in agreement with the view that energetic clarification, obtained by longer contact between the juice and the lime in the malaxators before satn., is very beneficial. Over-satn. slightly reduces in all cases the tendency of the amino acids towards pptn. This is true only if pure lime is used; the presence of magnesia is more detrimental. Under the conditions existing during the 2nd satn. (0.21% of CaO at a temp. of 95°), a noticeable amt. of amino acids is pptd. It seems that the former practice of adding small amts. of lime during the 2nd satn. is beneficial (*C. A.* 15, 186). This lime would decompose further the amides, asparagine and glutamine, and therefore, increase the amt. of amino acids remaining after the 1st satn. SO_2 during the 2nd satn. also ppts. amino acids, its action being aided by the lime. The amt. of pptd. amino acids, and in practice also of org. Ca salts, is greater during sulfitation than during carbonation. JOHN M. KRNO

The recovery of ammonia during clarification. JAR. HRUDA. *Listy Cukrovar.* 39, 113-5 (1921).—H. has found that, during clarification, using 2.5% of CaO at 80° , he could recover about 0.00055% of NH_3 , based on the wt. of the sliced beets. The amt. recovered depended on the temp. at which the clarification was conducted, and on the time of contact of the juice in the malaxator with the lime. The larger the malaxator in comparison with the size of the saturator, the greater was the yield of NH_3 , since the juice remained in the malaxator for a longer time. The amt. of NH_3 developed in the malaxator, equivalent to that produced during satn., was very insignificant and its recovery would be economically feasible only in conjunction with the recovery of the NH_3 escaping during evapn. JOHN M. KRNO

The recovery of ammonia from the first saturation. JAR. SILHAVY. *Listy Cukrovar.* 39, 71-2 (1920); *Z. Zuckerind. technol. Rep.* 45, 155-6 (1921).—Donath, basing his deduction on lab. expts. in which he used 2% of CaO, estd. that 88.6 kg. of NH_3 could be recovered during clarification in a factory slicing 600 tons of beets per day.

S. found that during the liming and carbonating operations, using 2% of CaO at 80-90°, he could recover only about 4.4 kg. of NH_3 or 16.9 kg. of $(\text{NH}_4)_2\text{SO}_4$ calcd. on 600 tons of beets per day. With 2.7% of CaO the amt. of $(\text{NH}_4)_2\text{SO}_4$ recovered equalled about 86 kg.

JOHN M. KENO

Control of alkalinity. E. A. KEELER. *Facts About Sugar* 12, 490 (June 18, 1921).—This is a description of the method of measuring hydrogen-ion concn. as a means for the detn. of acidity or alkalinity in the carbonation of sugar juices. An automatic recorder is used on the potentiometer. In addition to this feature and automatic control is the advantage of eliminating color differences.

N. KOPPELOFF

The complete applicability of the modified Clerget method. R. F. JACKSON AND C. L. GILLIS. *Facts About Sugar* 13, 10, 11, 14 (July 2, 1921); cf. C. A. 15, 1416.—This is a further reply to C. A. Browne's criticisms of the accuracy of the neutral polarization method, with a discussion of the effect of salt on the polarizing power of sucrose. Pure sucrose is analyzed by the author's methods No. 2 and 3, and identical results were obtained. The depressive power of the salt mentioned by Browne was not verified. Data are presented to show that the rotary power of sucrose in the presence of 3.392 g. of NH_4Cl is const. regardless of the concn. Many observations were made with small amts. of sucrose. At each of a number of concns., two solns. were prepd. contg. the same wt. of sucrose. One of these was made up to vol. with pure water, while to the other 3.392 g. NH_4Cl or 2.315 g. NaCl was added before the volume was made up. They were then polarized without particular reference to the zero point. This constituted a differential method of obtaining the quantities sought, as well as the depressive power of the salt at various concns. of sucrose. The agreement is close. By calcg. from Browne's polarizations of concd. solns. and by pointing out errors in the latter's polarization of dil. solns. the authors contend that the salt effect is const. even for concns. with respect to sugar far beyond those concerned in their method of analysis. Consequently, they consider Browne's principal criticism based on the major premise of a variation in salt content as invalid. Further tables of data are presented to show that no other variations occur such as might be induced by HCl , etc., and analyses are given by the modified Clerget method of pure sucrose solns. in varying concns.

N. KOPPELOFF

"Cay-Doc" gum from Tonkin (*Garcinia tonkinensis*). F. HEIM. *Bull. Office Colonial* 12, 413-24 (1919); *Bull. Agr. Intelligence* 11, 124-5.—Large quantities of this wound gum could be obtained from the province of French Indo-China. Beside vegetable impurities, the crude gum contains about 74% of a resin which may be sepd. easily by dissolving in benzine or acetone. The true gum is largely galactan which is easily hydrolyzed. A small amt. of araban is present and a little free glucose. Tests of the usefulness of the gum in the textile, and in the paper and cardboard industries will be made soon.

T. G. PHILLIPS

Polysaccharides. IV. Structure of potato starch (KARRER, NAGELI) 10. Alcohol and potassium compounds from molasses (U. S. pat. 1,378,662) 16.

SACHS, HENRI: Notes sur le controle chimique des sucreries. Second ed. 15 fr. Brussels, 64 rue de Longue-Vie. For a review see *J. fabr. sucre* 62, No. 25.

Year Book of the Louisiana Sugar Planters' Association. New Orleans. Mr. Reginald Dykers, Secretary of the Louisiana Sugar Planters Association, 424 Camp Street. For review see *Louisiana Planter* 67, 19 (1921).

29—LEATHER AND GLUE

ALLEN ROGERS

Leather nomenclature. J. H. YOCUM AND T. H. FAUST. *J. Am. Leather Chem. Assoc.* 16, 259-64(1921).—A list of words, terms, etc., used in the leather industry, to describe cuts, finishes and essential characteristics of the material. Meanings of each as applied to leather are given. C. F. JAMESON

Technology of chrome-tanned upper leather. W. C. JACKSON. *Am. Dyestuff Rep.* 3, No. 1, Sec. 2, 14-5; No. 6, Sec. 2, 11-3; No. 10, Sec. 2, 17-9; No. 14, Sec. 2, 26-8(1921).—A discussion of the chem. and mechanical operations of leather manuf., from beam house to finishing room. A general description of each process, formulas and many practical suggestions are given. C. F. JAMESON

The determination in leather of matter extractable by water. Committee report. JOHN ARTHUR WILSON, *et al.* *J. Am. Leather Chem. Assoc.* 16, 264-80(1921).—Because of wide discrepancies in the exptl. results of different members of the committee, it is difficult to draw conclusions. W. believes that a definite end-point can be obtained by extg. with water at room temp., that it is practicable to make complete extns. and det. the amt. of matter extractable by water by simply measuring the loss in wt. of the dry leather. This figure will decrease as leather "ages." C. F. JAMESON

Researches in tanning and the Calcutta Research Tannery. B. M. DAS. *J. Indian Ind. Labour* 1, 25-40(1921).—Since many tanning processes involve chemical and bacterial actions which are greatly influenced by temp., western methods have been found unsatisfactory when used in India. Rough outlines of methods may be obtained from the west, but detailed processes must be worked out locally by systematic research. The C.R.T. (founded in 1919) consisting of a chem. lab., bacteriol. lab., and a demonstration tannery is actively engaged in working out many of these problems and training apprentices to use modern methods in India. CHARLES F. JAMESON

The value of the pericarps of *Garcinia mangostana* L. in the tanning industry. F. HENR, J. MAHERU AND L. MATROD. *Bull. Poffice colonial* 12, 259-64(1919); *Bull. Agr. Intelligence* 10, 1256-7.—This waste product of an edible fruit, grown in all tropical orchards, contains 13.61% tannin suitable for tanning, but the high non-tannins, 14.56%, make it useless in the French tanneries. T. G. PHILLIPS

The color measurement of vegetable tanning solutions—Committee report. T. BLACKADDER, *et al.* *J. Am. Leather Chem. Assoc.* 16, 280-3(1921).—A rigid test of the Hess-Ives tint photometer has been made. The type of bulb used was found to make very slight difference in readings. Different operators also obtained very concordant readings. The power of the machine to differentiate between solns. was found to be poor. Fe present in the ext. caused a lowering of readings. This fault was obviated by the use of a different set of color screens. The committee believes a machine based on spectrum analysis could be adapted to its needs. It wishes to continue its study and invites criticism. C. F. JAMESON

The properties of gelatin. LOUIS MEUNIER. Faculté des Sciences de Lyon. *Chimie & industrie* 5, 642-50(1921).—Review of various properties of gelatin: amphoteric characteristics, influence of electrolytes contained in the gelatin on its properties, influence of the valence of the ions entering into the constitution of the gelatin, detn. of its p_n , constitution of gelatin jellies, tanning with halogens, inorg. salts, and org. compds. A. P.-C.

Waterproofing porous materials (U. S. pat. 1,376,553) 18.

Tanning. CHEMISCHE FABRIKEN WORMS AKT. GES. Brit. 156,186, Jan. 3, 1921.

A tanning process consists in the use of mixts. of heavy salts of ligninsulfonic acids from waste sulfite liquors, with salts of other org. or inorg. acids such as H_2SO_4 , HCO_2H , lactic acid, etc., and with or without addition of other tanning or non-tanning agents. The mixed salts ppt. glue and do not flocculate in dil. aq. solns. The following examples are given: (1) Tanning is effected with a liquor containing about 2-3% of tanstuff prepd. by decomposing an aq. soln. of 100 kg. of Na ligninsulfonates with 100 kg. of cryst. $\text{Al}_2(\text{SO}_4)_3$. The soln. may be used directly or evapd. to dryness. The leather obtained is then stuffed and dried. (2) Tanning is effected as in example (1) with a tanstuff prepd. by decomposing 100 kg. of Ca ligninsulfonates with 170 kg. of cryst. $\text{Fe}_2(\text{SO}_4)_3$; the CaSO_4 is filtered off.

Synthetic tanning agents. CHEMISCHE FABRIKEN & ASPHALTWERKE AKT.-GES. Brit. 156,254, Jan. 4, 1921. Synthetic tanning agents consisting of coupled aromatic compds., coupled aromatic and aliphatic compds., or coupled org. compds. and vegetable tanning agents, are converted into Al or Cr salts, which also are tanning agents, by treating the free acids or their salts, or mixts. thereof, with Al or Cr compds., or mixts. thereof. Numerous examples are given.

Tanning substances from naphtholsulfonic acids. A. RÖMER. U. S. 1,375,975, Apr. 26. A product having strong glue-ptgt. properties is obtained by heating 2-hydroxynaphthalene-6-sulfonic acid or a similar naphtholsulfonic acid to a temp. of about 100-120° together with P oxychloride or concd. H_2SO_4 . U. S. 1,375,976 relates to the manuf. of a glue-ptgt. substance by treating a naphthalene sulfone such as β -dinaphthyl sulfone with a sulfonating agent, e. g., H_2SO_4 at 200°, and reacting upon this intermediate product with CH_2O soln. and partly neutralizing with soda lye.

Coating leather with metal. W. H. MEADE and S. H. FRIESTEDT. U. S. 1,376,961, May 3. A metal coating for use on leather is prepd. by pptn. of the metal from a sol. compd., e. g., by pptg. Cu from CuSO_4 soln. with Zn dust.

Setting out and drying hides and skins. C. L. WHITNEY. U. S. 1,376,238, Apr. 26. Hides or skins are set out on a drum from which they are mechanically transferred to a drying frame.

30—RUBBER AND ALLIED SUBSTANCES

JOHN B. TUTTLE

The present status of the world's supply of crude rubber. A. DOMINIKUS. *Elektrotechn. Z.* 42, 622-5(1921); 4 illus.—A critical review. C. G. F.

The variability of crude rubber. JOHN B. TUTTLE. *J. Ind. Eng. Chem.* 13, 519-22(1921).—The usual method for the testing of crude rubber is by means of tensile tests on sheets vulcanized from a compd. containing 90% rubber and 10% S, or some similar mixt. of rubber and S only. Such tests det., not the variability in the crude rubber, but in the minute amts. of accelerators which may have been present in the latex, and were retained by the rubber during coagulation, or else formed after coagulation. It is recommended that the tests be performed with ZnO and an accelerator, in order to eliminate the effect of the small amts. of impurities present, and thus develop the facts regarding the rubber itself. J. B. T.

The aging of certain rubber compounds. W. B. WIEGAND. *India Rubber J.* 61, 604-5 (1921).—Criticism of the work of Ruby and Depew, cf. C. A. 15, 192. J. B. T.

Carbons and hydrocarbons used in the rubber industry. FREDERIC DANNER. *India Rubber World* 64, 742-4(1921).—A general review of the subject. J. B. T.

The advantage of water vulcanization. ARTHUR P. FRISWELL. *India Rubber*

World 64, 662-3(1921).—A description of the method of vulcanizing mixts. of rubber and S in sheet form, by immersion in water. J. B. T.

Amyrin and lupeol in the rubber of *Ficus vogelli*. A. J. ULTEE. *Ber.* 54B, 794-5(1921).—Spence (C. A. 1, 1568) obtained from the rubber of *Ficus vogelli* two alc.-sol. fractions which were identified by him as *alpha* and *beta* alban. Ultee shows these compds. to be *alpha* amyrin acetate and lupeol acetate. ALAN LEIGHTON

The relative thermal conductivity of some rubber compounds. A. A. SOMMERVILLIS. *Rubber Age* 9, 131(1921).—Sheets of rubber, 7 x 7 x 0.1 in., were piled up on top of a water-jacketed boiler, and a pan of cracked ice was placed on top of the rubber sheets. Thermocouples were inserted between the sheets. The difference in temp. between the two sides of a sheet was taken as a measure of its cond. The temp. gradient of pure rubber compds. was taken as unity. The effect on this temp. gradient caused by the introduction of various fillers was detd., and a table of results is given. The error of the detn. is admitted to be large, but the general results are claimed to be significant. J. B. T.

The relative accelerating action of different compounds of lead in the vulcanizing of rubber. J. M. GROVE. *India Rubber World* 64, 663-4(1921).—G. shows that of the most commonly used lead compds., litharge gives the greatest accelerating action. Basic lead carbonate and sublimed blue lead have only one-third the action of litharge; sublimed white lead is inferior to the other lead compds. G.'s results raise a serious doubt as to whether or not the accelerating action of basic lead carbonate is entirely dependent upon the proportion of $Pb(OH)_2$ present. J. B. T.

Antimony sulfuret (sulfide); its manufacture and use. D. A. SHIRK. *Rubber Age* 9, 87-90(1921).—A review of the methods for the manuf. of Sb_2S_3 ; together with the effect of the pentasulfide and trisulfide on the vulcanization of rubber. J. B. T.

India-rubber Goods Manufacture. London: Maclaren & Sons Limited. 37-38 Shoe Lane, E. C. 4. For review see *Chem. Weekblad* 18, 353(1921).

Chlorinated rubber compounds. C. W. BEDFORD and W. J. KELLY. U. S. 1,377,152, May 3. Tough compds. of varying degrees of plasticity and resistant to chemicals are formed by treating rubber with S and then with Cl. Scrap rubber, freed from excess of free S, may be suspended in CCl_4 and Cl passed through the suspension. Reclaimed rubber suitable as starting material may also be prepd. by dissolving and reppn.

Vulcanizing rubber. W. R. BURKE. U. S. 1,375,360, Apr. 19. A layer of unvulcanized rubber with an elec. heating element in direct contact with it is employed for vulcanizing repairs on tires, etc.

Reworking old vulcanized rubber. J. PORZEL. U. S. 1,374,231, Apr. 12. Vulcanized rubber is reduced to a state of fine division out of free contact with air, a small quantity of new unvulcanized rubber is added, sufficient merely to form a film upon the particles of old rubber, the new rubber being dissolved and distributed by a solvent such as CCl_4 or gasoline and the mixt. is shaped and vulcanized. Material thus made is suitable for the manuf. of various resilient articles.

Apparatus for vulcanizing rubber tires, etc. I. K. RYSTEDT. U. S. 1,376,463, May 3.

Depolymerizing vulcanized oils. W. O. SNELLING. U. S. 1,376,172, Apr. 26. A vulcanized oil product such as may be obtained by reaction of S chloride on cottonseed oil is depolymerized by the action of gaseous HCl in order to obtain a plastic cohesive product.

Vulcanized oil mixture. W. O. SNELLING. U. S. 1,376,173, Apr. 26. Different portions of vulcanized oil products of different degrees of plasticity are blended in order to obtain a product of desired quality, *e. g.*, for compounding with rubber.

Vulcanized oil product. W. O. SNELLING. U. S. 1,376,174, Apr. 26. A liquid vulcanized oil product capable of being transformed into a solid factis-like material on contact with H_2O and adapted for depolymerization to a plastic mass is prepd. by heating together cottonseed oil 67, CS_2 16 and S chloride 17 parts.

Puncture-healing composition. C. O. HOPPING. U. S. 1,375,510, Apr. 19. A mixt. adapted for healing punctures in rubber tires is prepd. by boiling paper pulp or similar vegetable fiber pulp in H_2O and then adding a mucilaginous substance such as starch and gum arabic to the pulp and H_2O mixt. while the latter is still hot.

Tire-filling mixture. J. A. SCHMIDTKE. U. S. 1,376,973, May 3. A filler for use in tires as a resilient body is formed from vegetable oil 74, MgO 2.2, ultramarine 2.2, PbO 2.2, oakum 1.9 and S chloride 17.5%.

